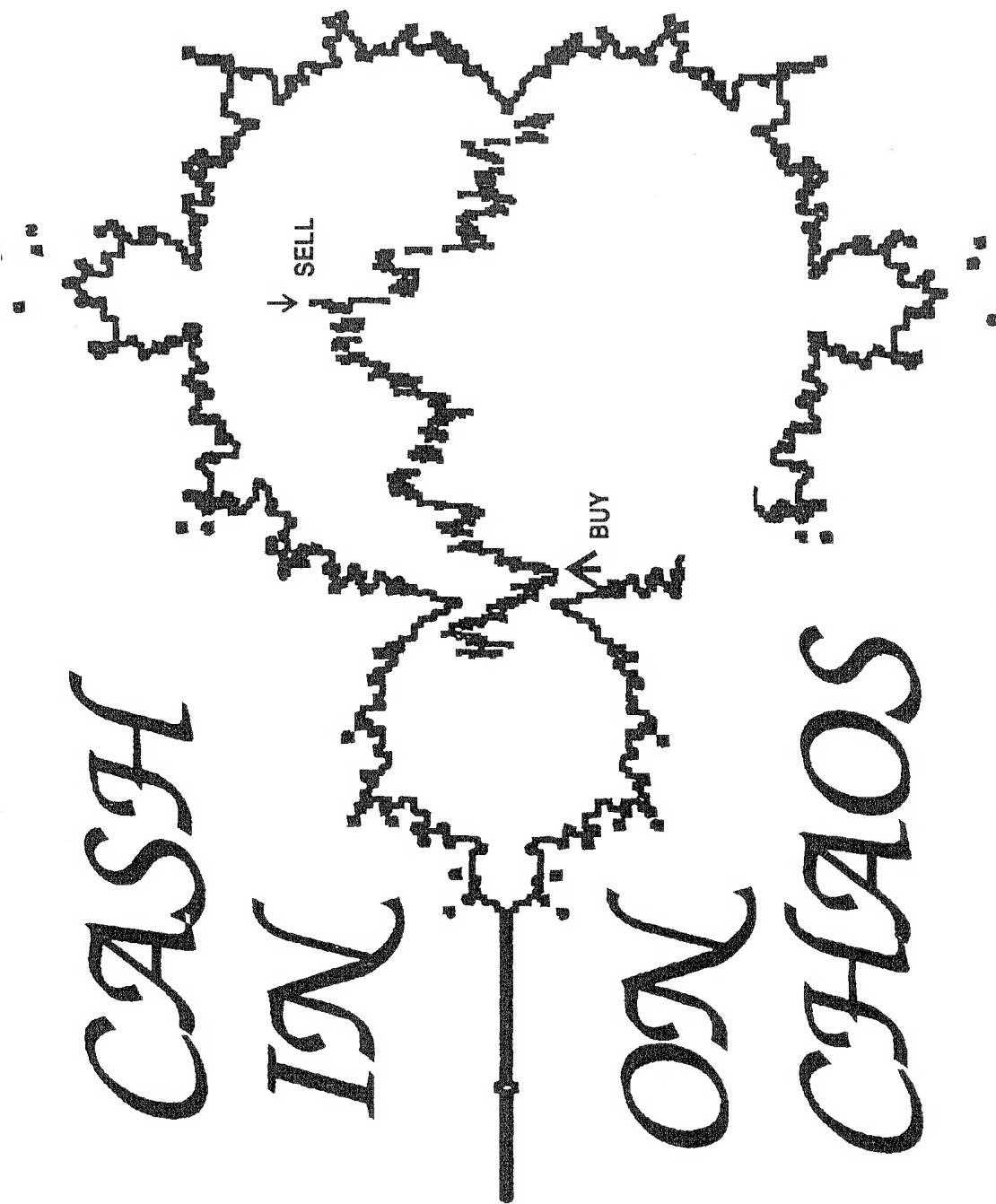


CASH

IN


ON

CHAOS



Dr. Hans Hannula, PhD, RSA, CTA

MY INFORMATION CLASSIFICATIONS

1. **PUBLIC**
Chaos Clamshell, 7 moves, Pearl of Wisdom
 2. **CONFIDENTIAL**
Cash In On Chaos Course
 3. **SECRET**
MAP Masters Course-Part 1
 4. **TOP SECRET**
MAP Masters Course-Part 2
 5. **CRYPTO SECRET**
equations, engineering simulation, neural nets
- 
- covered by
state, federal,
and international
trade secrecy
laws

**What you get today is sufficient for successful use
in real world trading.**

GOALS

1. DE-MYSTIFY CHAOS
2. OVERCOME JARGON BARRIERS
3. DE-MYSTIFY MARKETS
4. GIVE YOU A TRADING EDGE

*Make everything as simple as possible,
but no simpler.*

-Dr. Albert Einstein

CASH IN ON CHAOS

1. What Chaos is

- system concept
- linear systems
- non-linear systems

2. Behavior of Non-linear Systems

- state space
- strange attractors
- strange repellers
- tests for data series

3. Limit Cycles

- linear and nonlinear
- finding on charts

4. Frequency shifts

- frequency doubling
- fibrillation
- tracking with
Zero Delay filter

CASH IN ON CHAOS

5. Fractal Dimension

- Mandelbro't's Fractal Geometry
- Fractal Dimensions of Coastlines
- Polarized Fractal Efficiency

6. Fractal Patterns

- Iterated Function Sequences
 - algebraic
 - geometric

7. The Hannula Market Fractal

- Basic Shape
- Variations
- Structure
- Measures
- Projections

CASH IN ON CHAOS

8. Trading Examples

- Entry Points**
- Exit Points**
- Hannula Hook**
- SAR**

9. Sources of Market Chaos

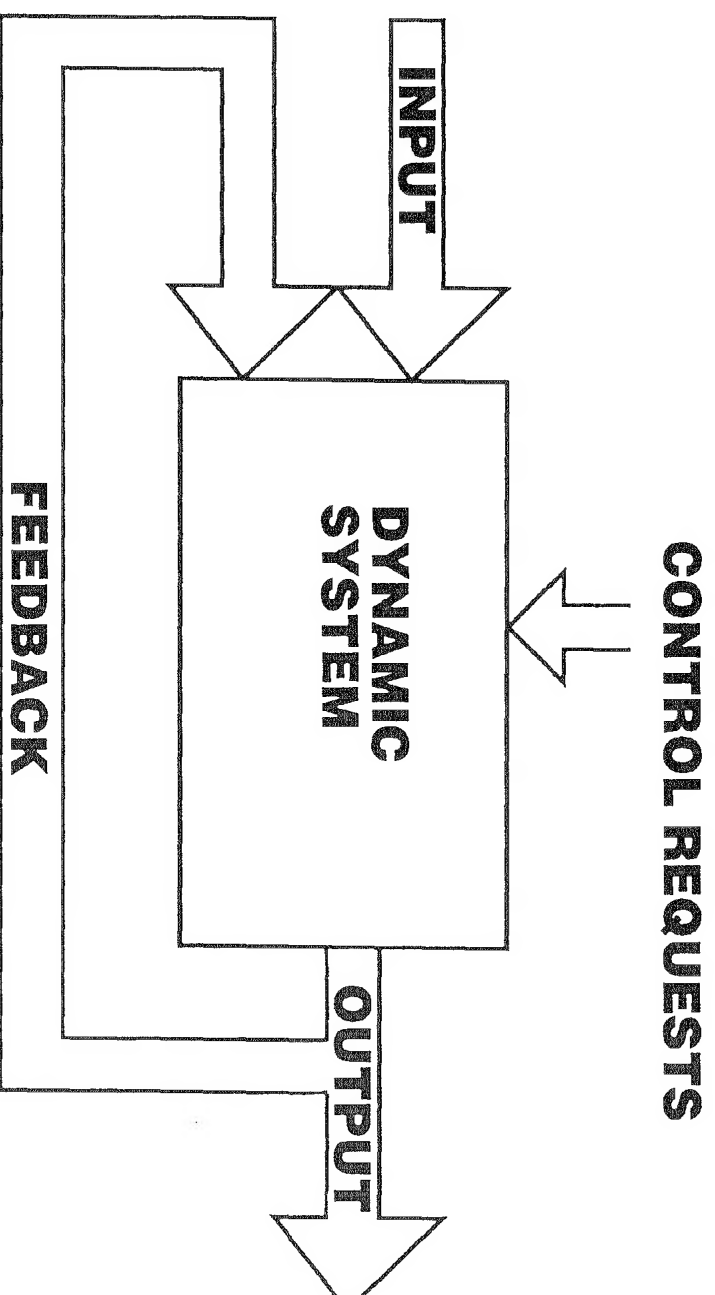
- Market Astrophysics**
- Sources of nonlinearity**
- Examples**
- Lunar Chaos Theory**

10. Conclusion

- Summary**
- Software Demo**
- Reading references**

What is chaos?

CHAOS IS A SYSTEMS CONCEPT

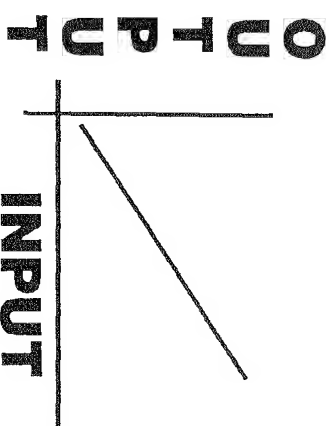


SYSTEM EXAMPLES

SYSTEM	INPUT	SYSTEM COMPONENTS	OUTPUT
AUTO SUSPENSION		SPRINGS,SHOCKS, TIRES, AXLE	
CAMERA			
HEART			
STOCK MARKET		<i>floor broker, computerized</i>	<i>price</i>
PLANETS			

**KNOWLEDGE OF SYSTEM CONSTRUCTION PERMITS
MATHEMATICAL CALCULATIONS OF BEHAVIOR.**

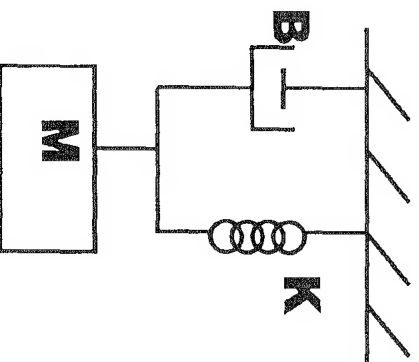
A LINEAR SYSTEM IS ONE IN WHICH THE OUTPUT IS DIRECTLY PROPORTIONAL TO THE INPUT



proportional

output

MODEL



MATHEMATICS

force

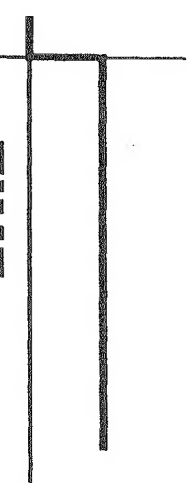
$$f(t) = m\ddot{x} + b\dot{x} + kx$$

m, b, k constant

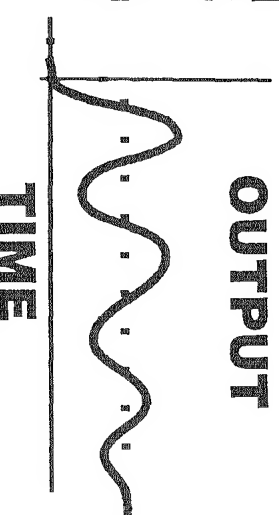
This is a linear differential equation, easily solved

BEHAVIOR

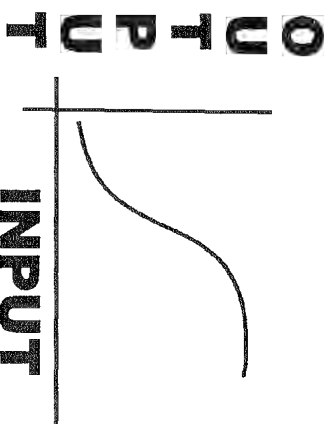
THE
INPUT
IS
A
STEP
FUNCTION



THE
OUTPUT
IS
A
Damped
Oscillation

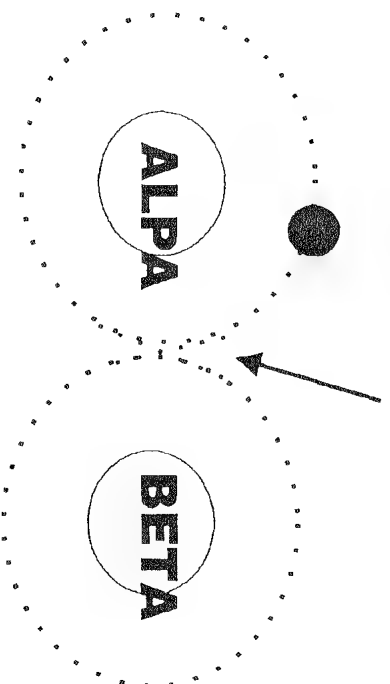


A NONLINEAR SYSTEM IS ONE IN WHICH THE OUTPUT IS NOT DIRECTLY PROPORTIONAL TO THE INPUT



MODEL MATHEMATICS
bifurcation

BEHAVIOR



Sum of Forces
on satellite=0
 $F(\text{alpha})$
+ $F(\text{beta}) = 0$

**SATELLITE BETWEEN
TWO PLANETS**

1. Sensitive to initial conditions
2. can take several forms
 - a. crash on alpa
 - b. orbit alpa
 - c. orbit beta
 - d. orbit both
 - e. crash on beta

Behavior of Nonlinear systems

STATE SPACE

is a plot of one system "state" or property, such as position, versus another, such as velocity. Time is omitted, except as it evolves along the plot. This gives a nice graphic tool for looking at systems.

X=POSITION

X=POSITION

LIMIT CYCLE

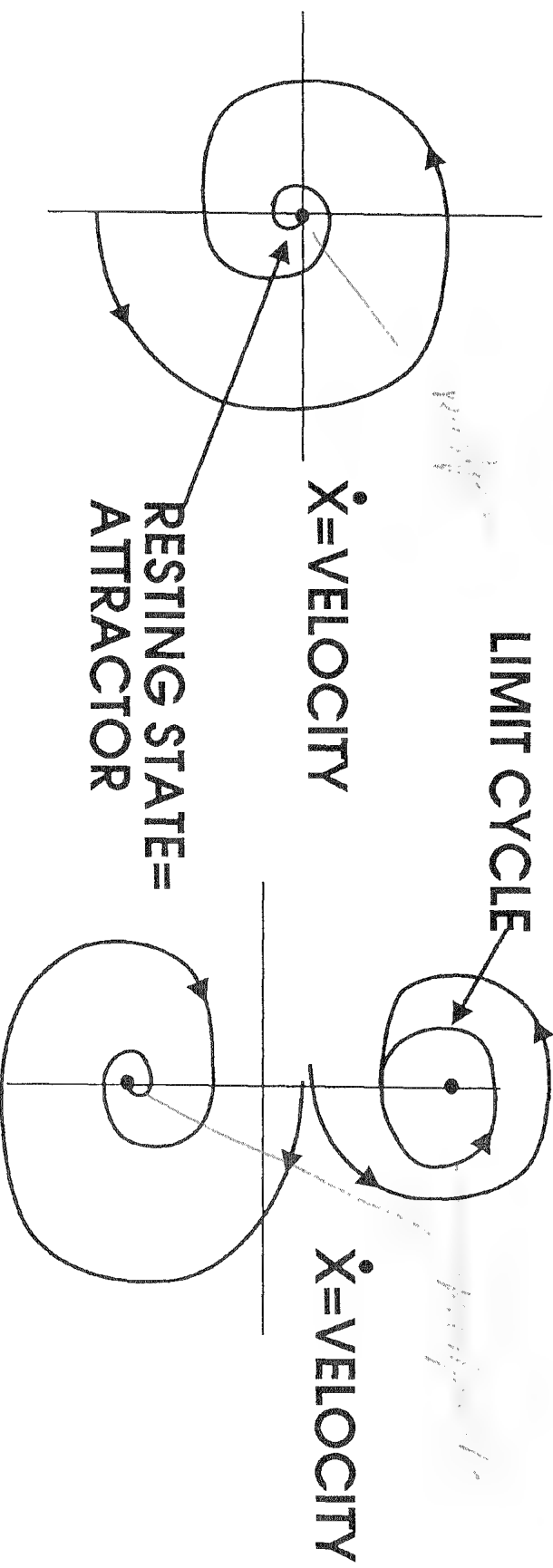
\dot{X} =VELOCITY

\dot{X} =VELOCITY

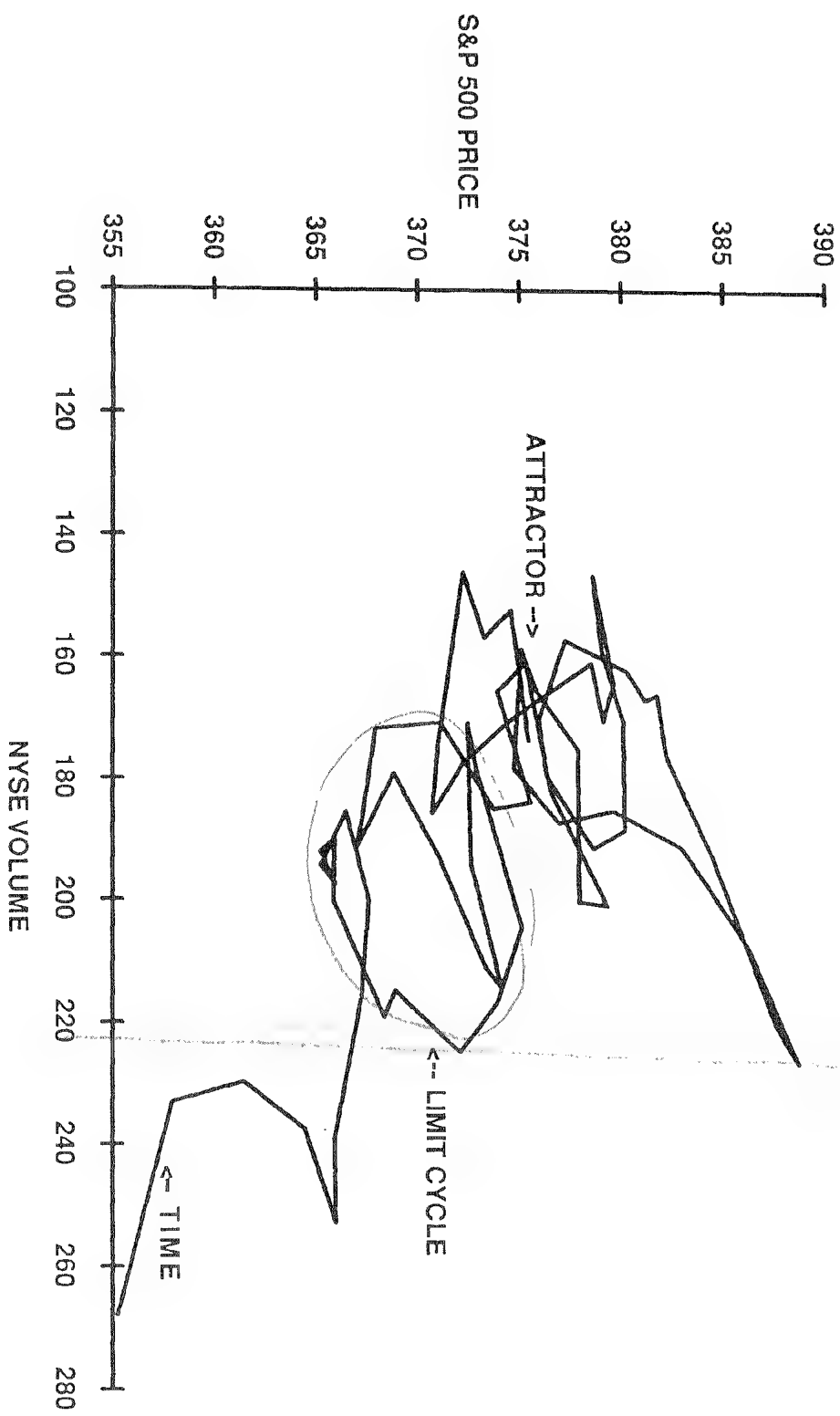
RESTING STATE=
ATTRACTOR

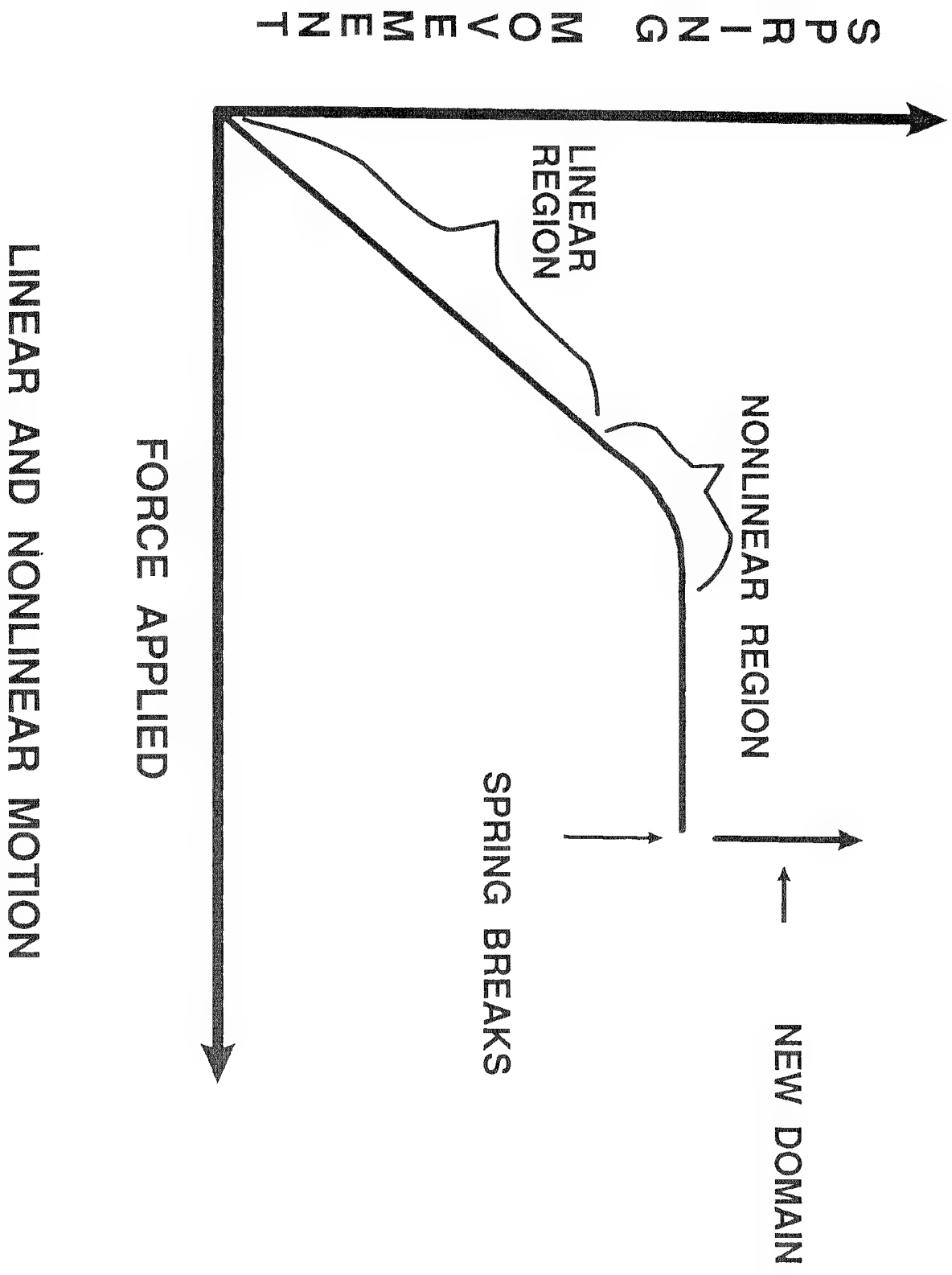
LINEAR SYSTEM

NONLINEAR SYSTEM



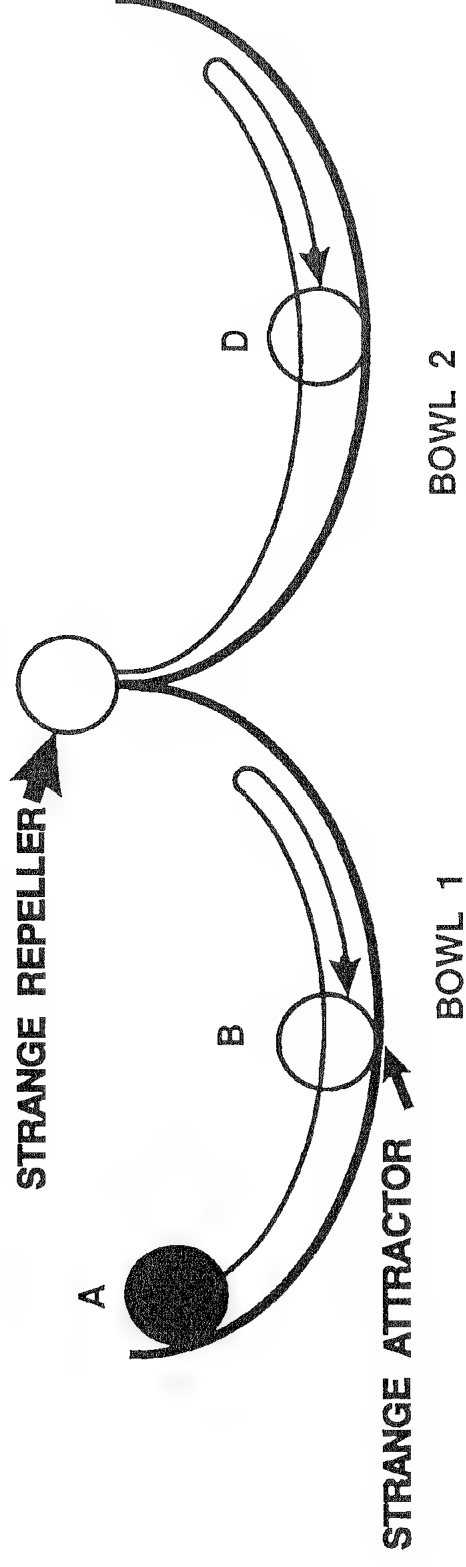
STATE SPACE PLOT OF PRICE VS. VOLUME





LINEAR AND NONLINEAR MOTION

ONE DOMAIN *balancing* ANOTHER DOMAIN



CHAOTIC BEHAVIOR

CHAOTIC SYSTEMS

- ARE NONLINEAR
- ARE NOT RANDOM
- DESCRIBE MANY NATURAL SYSTEMS
- EXPLAIN HOW SMALL FORCES CAN HAVE A BIG EFFECT
- CAN, DO, AND WILL MAKE SUDDEN AND ABRUPT CHANGES OF STATE

-ARE DESCRIBED BY MANDELBROT'S FRACTAL GEOMETRY

- not Euclidian
- shapes have
 - scaling effects
 - self-similarity
- fractal dimension

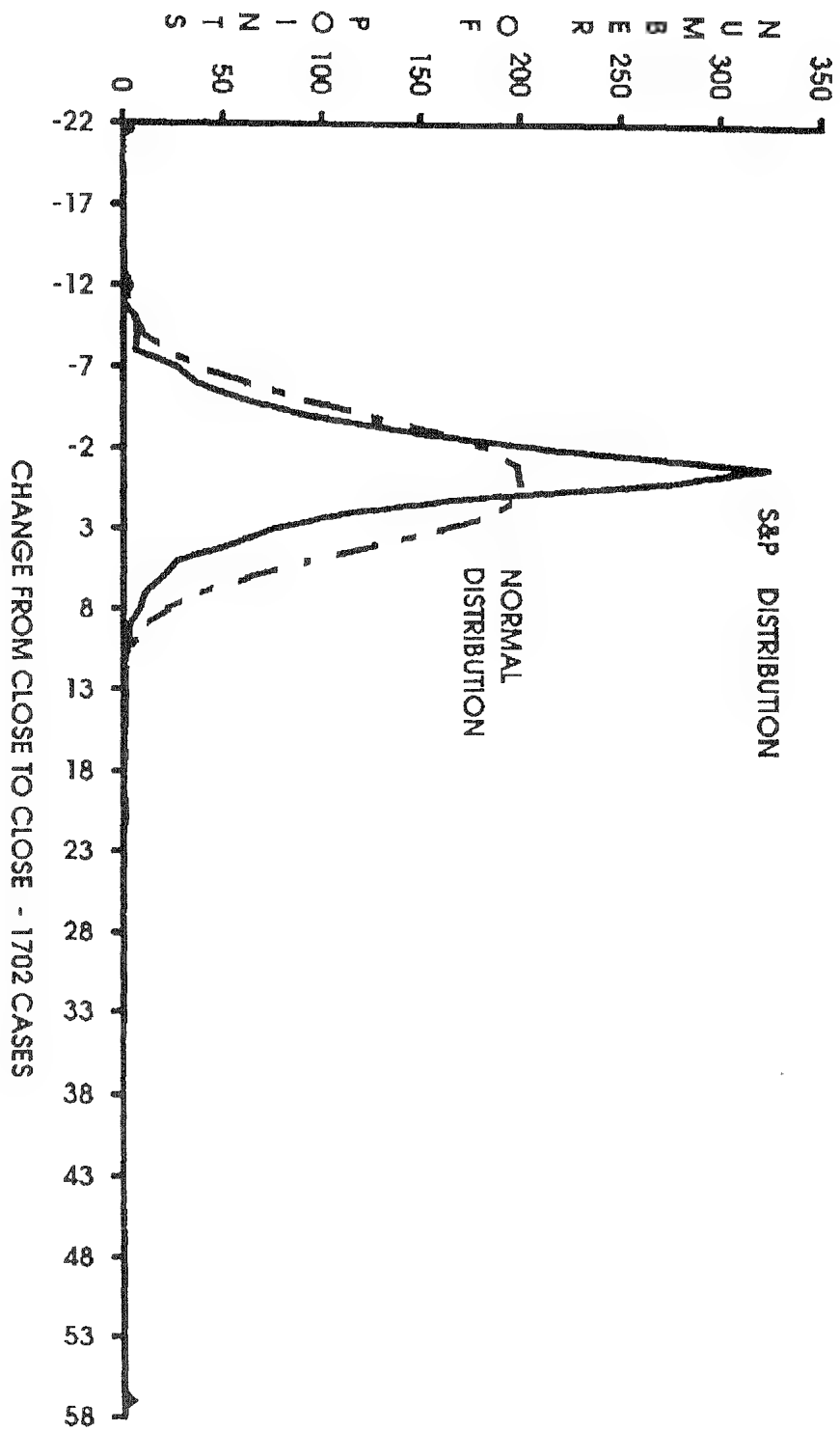


-ARE DESCRIBED BY PARETIAN STATISTICS, NOT GUASSIAN

- invalidates the Efficient Market Theory (and related things, like option pricing model)
- permits vertical gaps in data
- data can be mathematically tested



S&P 500 DAILY CHANGE DISTRIBUTION



TESTING WITH THE HURST EXPONENT

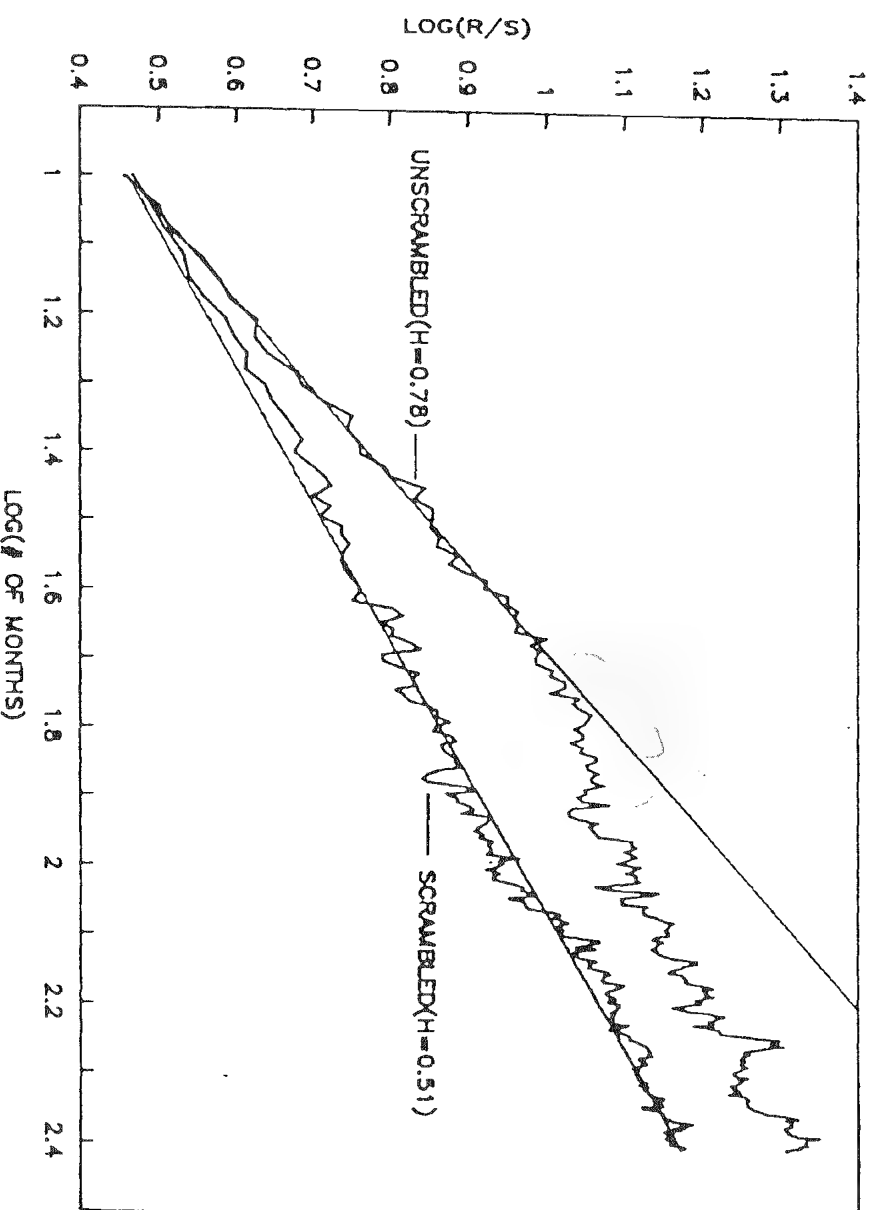
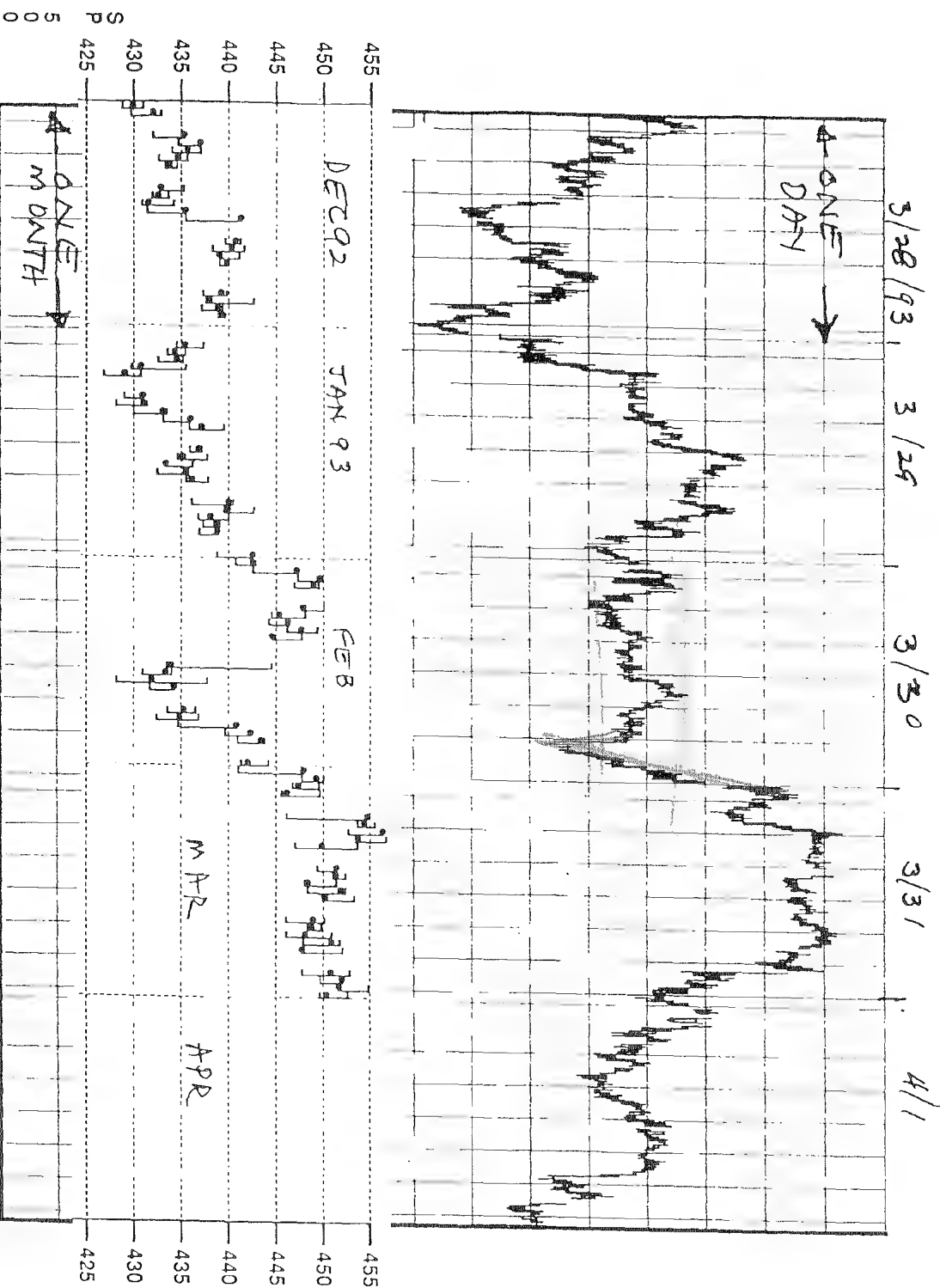


FIGURE 8.3 Scrambling test: S&P 500 monthly returns, January 1950–July 1988. Unscrambled $H = 0.78$; scrambled $H = 0.51$.

from Edgar E. Peters,
CHAOS and ORDER in the CAPITAL MARKETS,
John Wiley, 1991

FRACTAL SELF-SIMILARITY AND SCALING



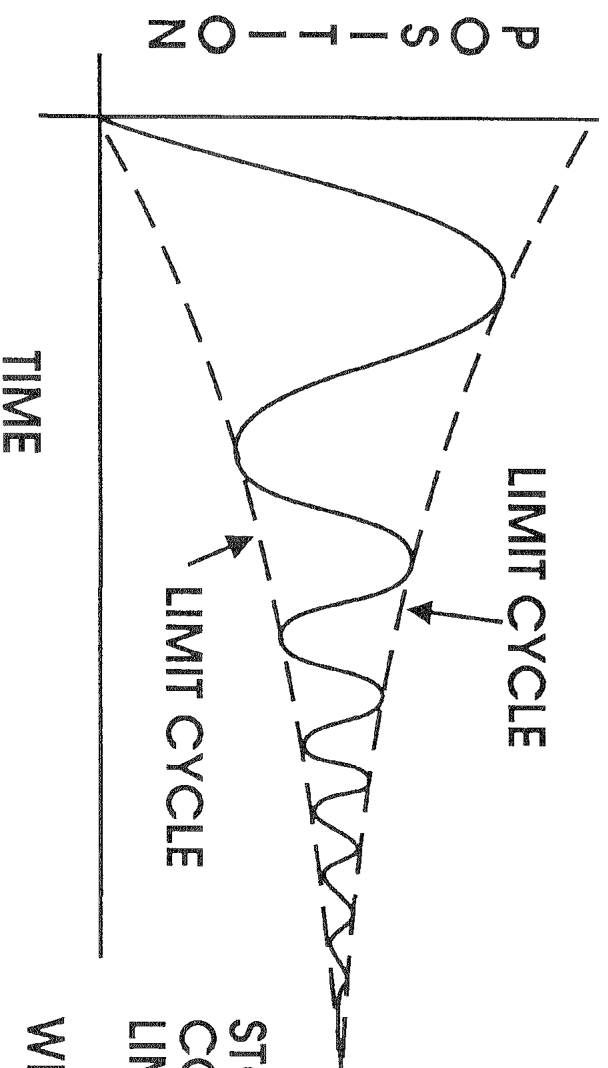
Limit Cycles

LIMIT CYCLES

3/11

LIMIT CYCLES ARE

- PERFORMANCE ENVELOPES OF A SYSTEM
- USUALLY NOT PLOTTED OR SEEN
- THE MOST IMPORTANT THING YOU HAVE NEVER SEEN IN MARKETS



STOCKS AND
COMMODITIES HAVE
LIMIT CYCLES.

WE CALL THEM (leading)

EXAMPLE: AUTO MASS, SPRING, DAMPER

THEY ARE BOTH AND

IN MY NOVEMBER 1989 NEWSLETTER I
 PREDICTED THE END OF THE NIKKEI BULL
 MARKET FROM 1949, WITH A MAJOR
 COLLAPSE TO FOLLOW. I MISSED
 THE TOP BY 2 DAYS AND 2000 POINTS.

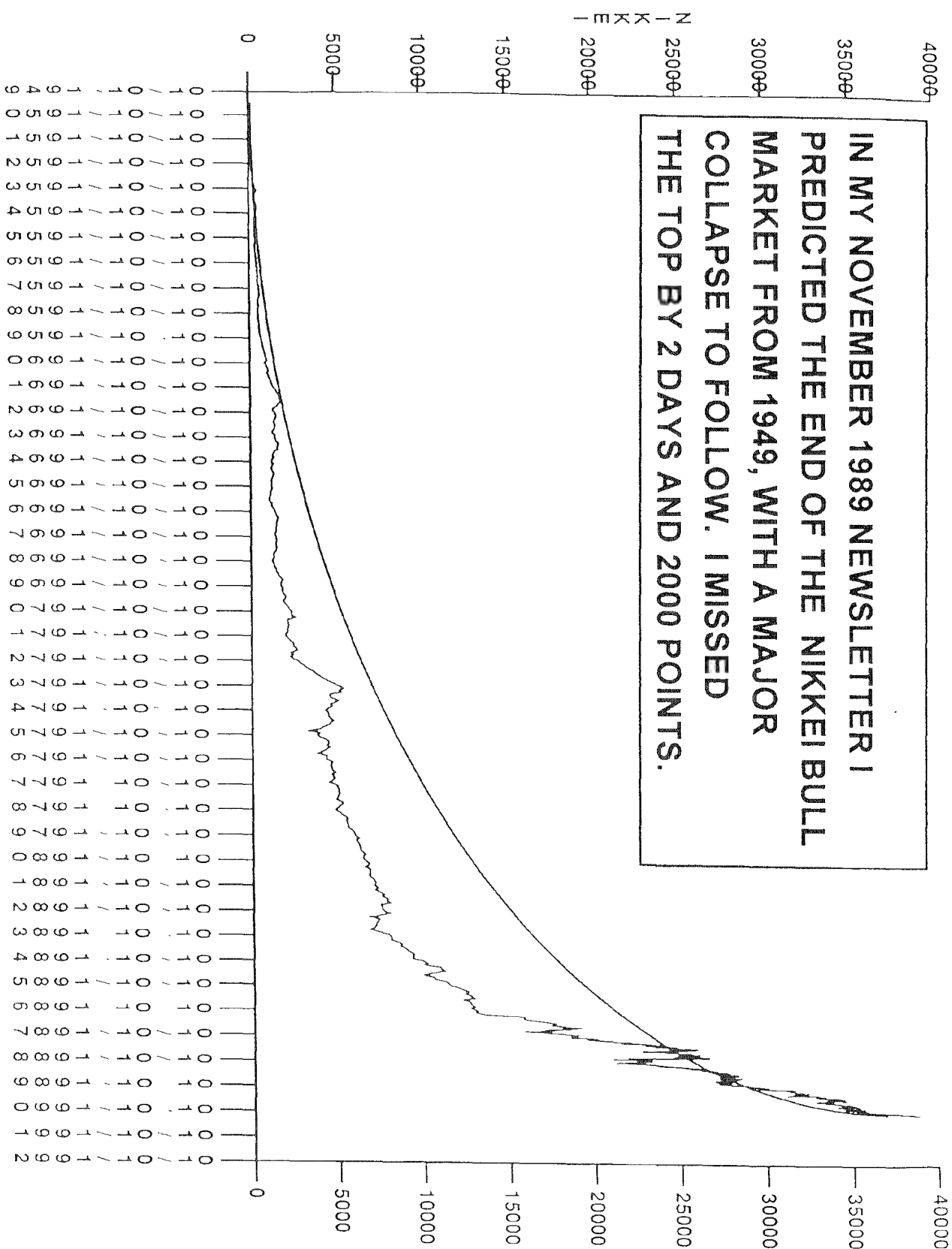
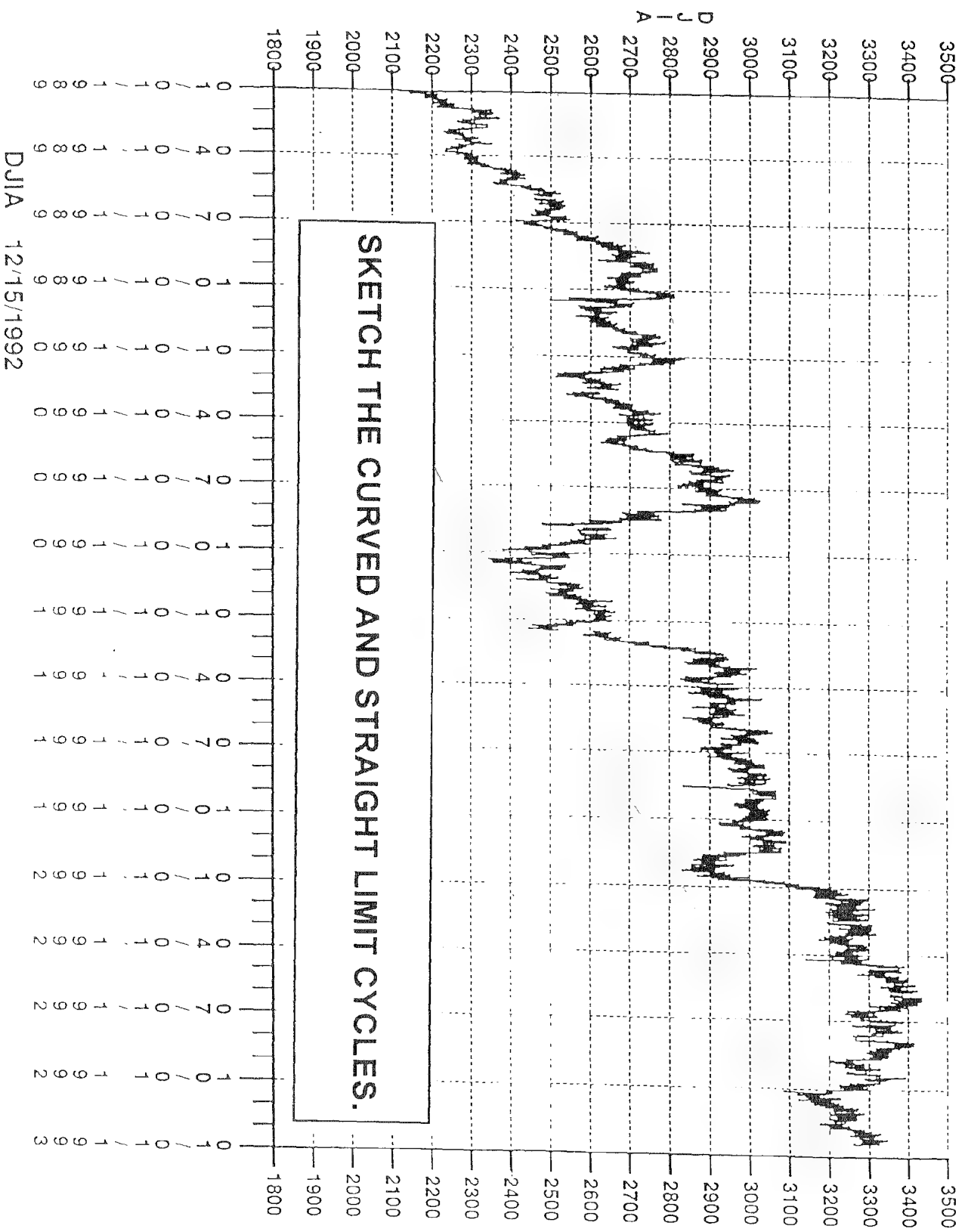
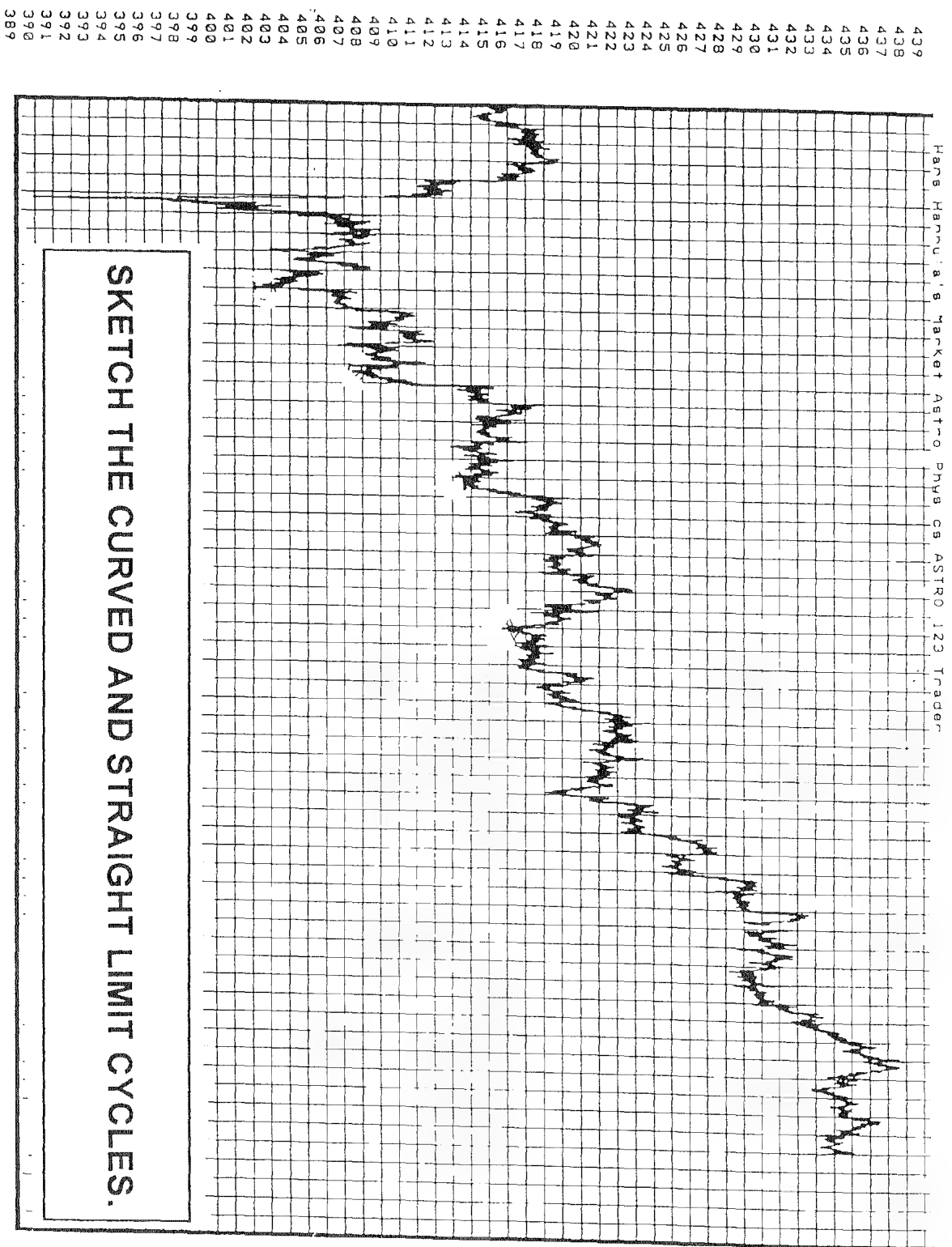


FIGURE 7. NATURAL GROWTH BOUNDARY OF THE NIKKEI

EXPECT CHAOS WHERE NONLINEAR
AND LINEAR LIMIT CYCLES
OR TWO NONLINEAR LIMIT CYCLES







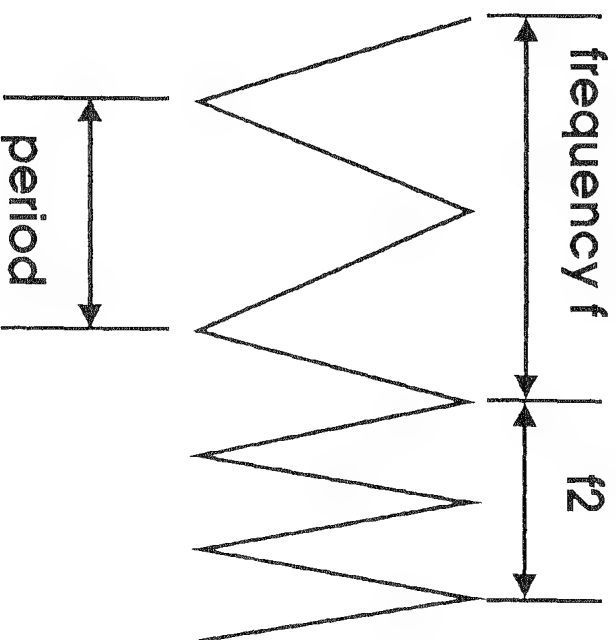
S&P 500 NEAR

DOSPNER2

Frequency shifts

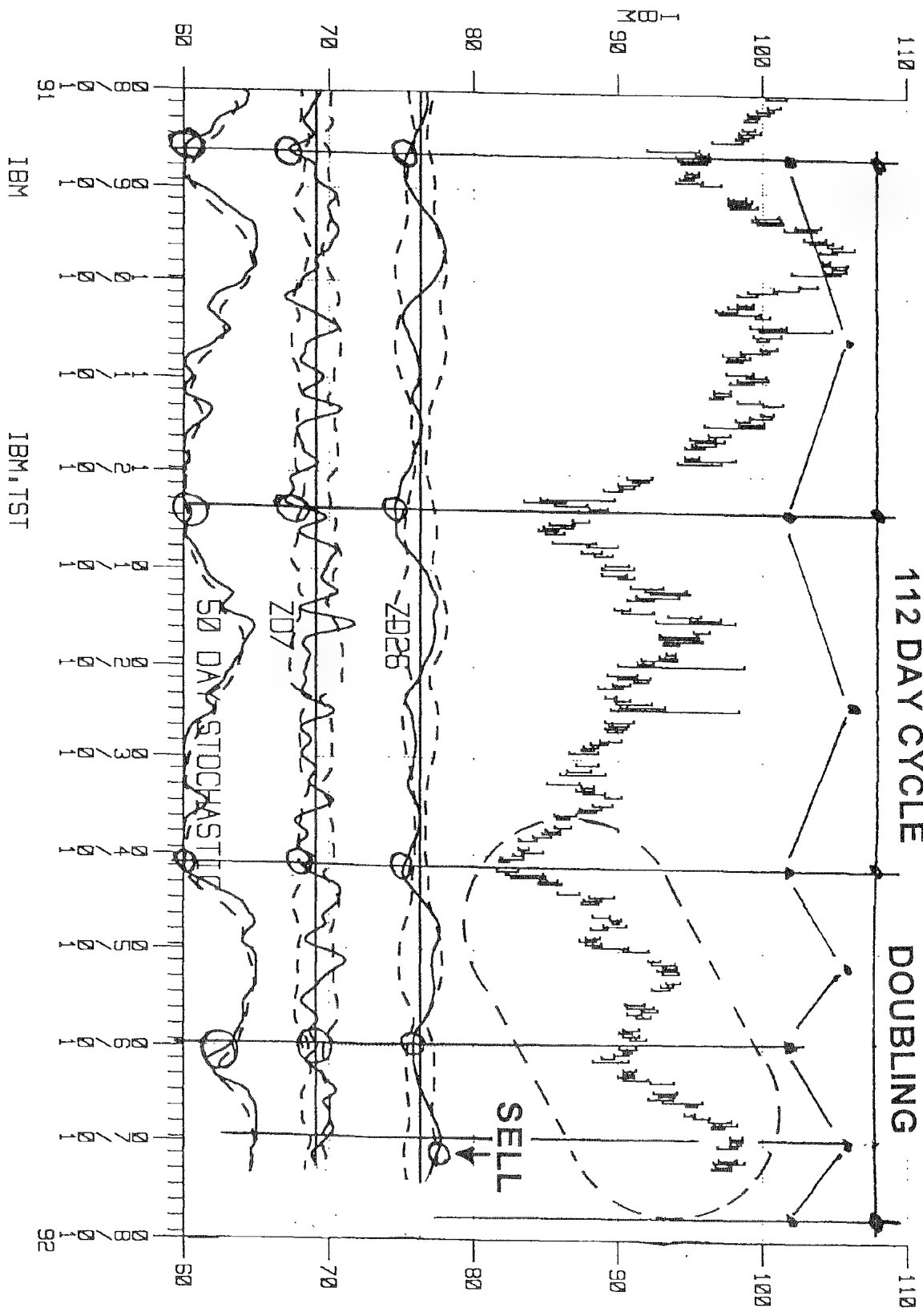
FREQUENCY SHIFTS

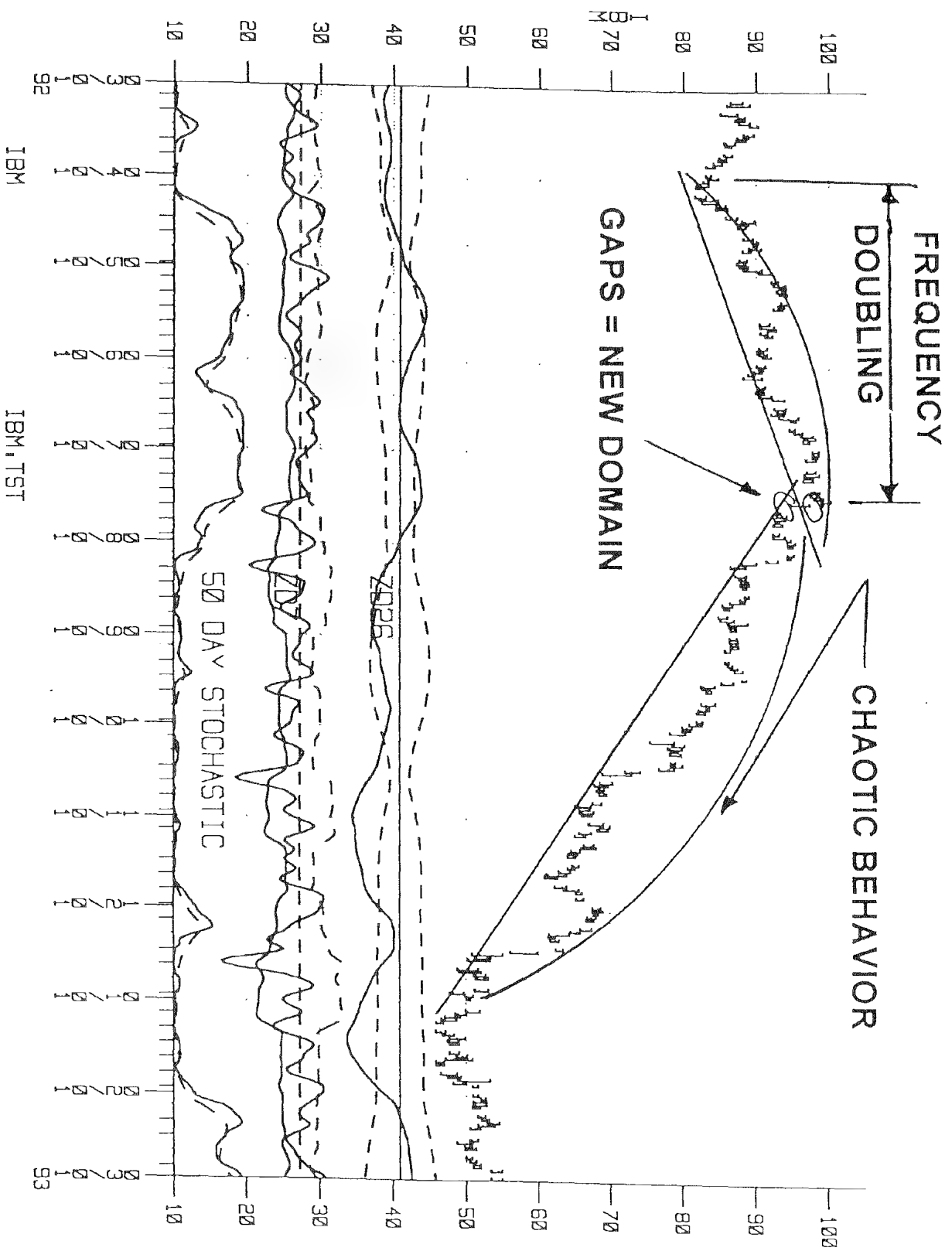
CHAOTIC SYSTEMS OFTEN EXHIBIT
A DOUBLING OF FREQUENCY JUST
BEFORE ENTERING CHAOTIC BEHAVIOR.



frequency = $1 / \text{period}$
measures how fast things change

FREQUENCY DOUBLING

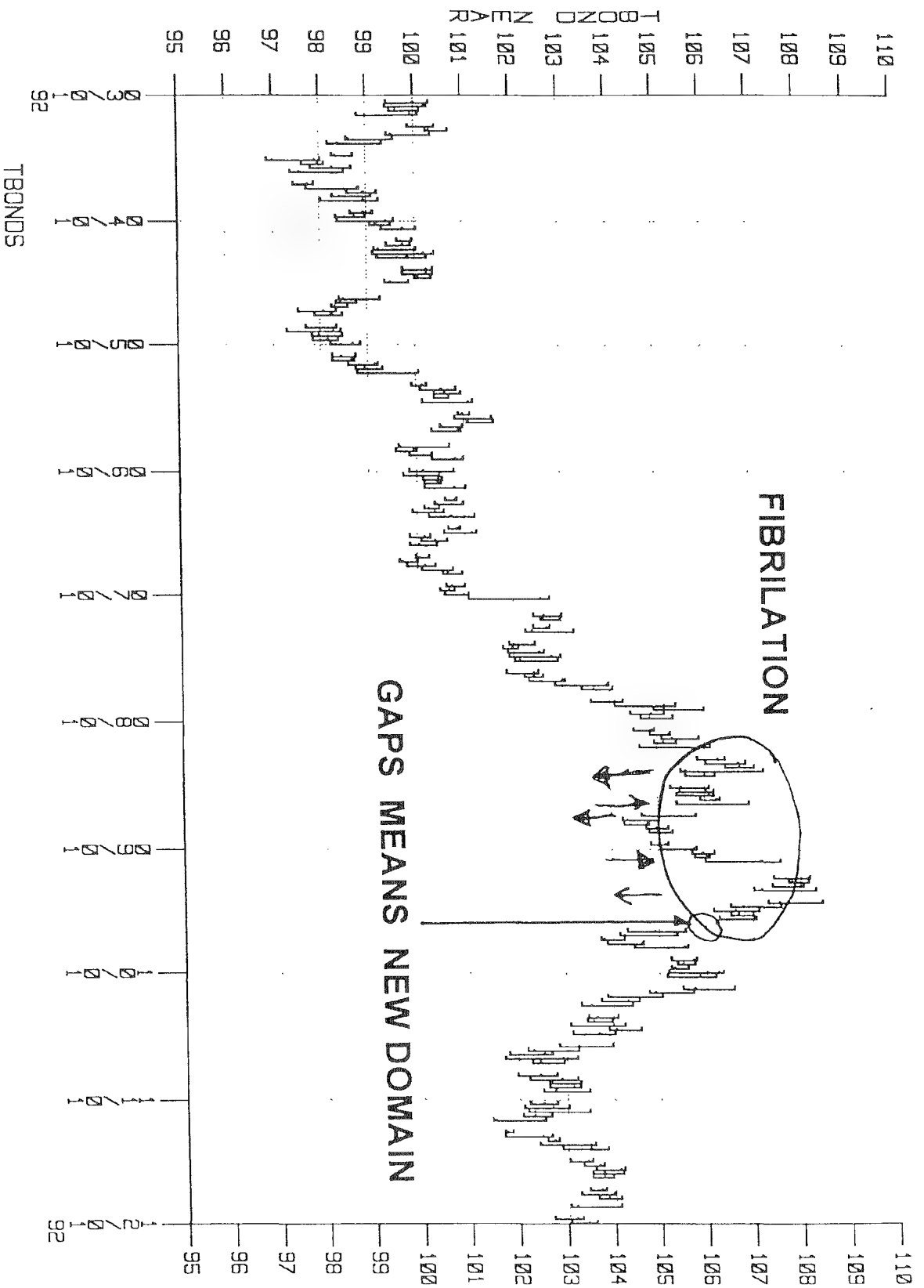




FIBRILATION

FIBRILATION IS A CONDITION WHERE
THE RHYTHMIC MOTION "looses its beat"
AND CHANGES VERY RAPIDLY.

IT IS FOLLOWED BY CHAOS.



HEART ATTACKS ARE A WELL KNOWN EXAMPLE OF FREQUENCY SHIFTS AS PRECURSORS TO CHAOS

Imagine shovelling heavy, wet, spring snow:

- 1. Load increases**
- 2. Heart pumps harder**
- 3. Heartbeat jumps to twice as fast**
- 4. If you don't act**
- 5. Heart enters fibrillation**
- 6. Heart attack occurs**

MONITORING FREQUENCY SHIFTS

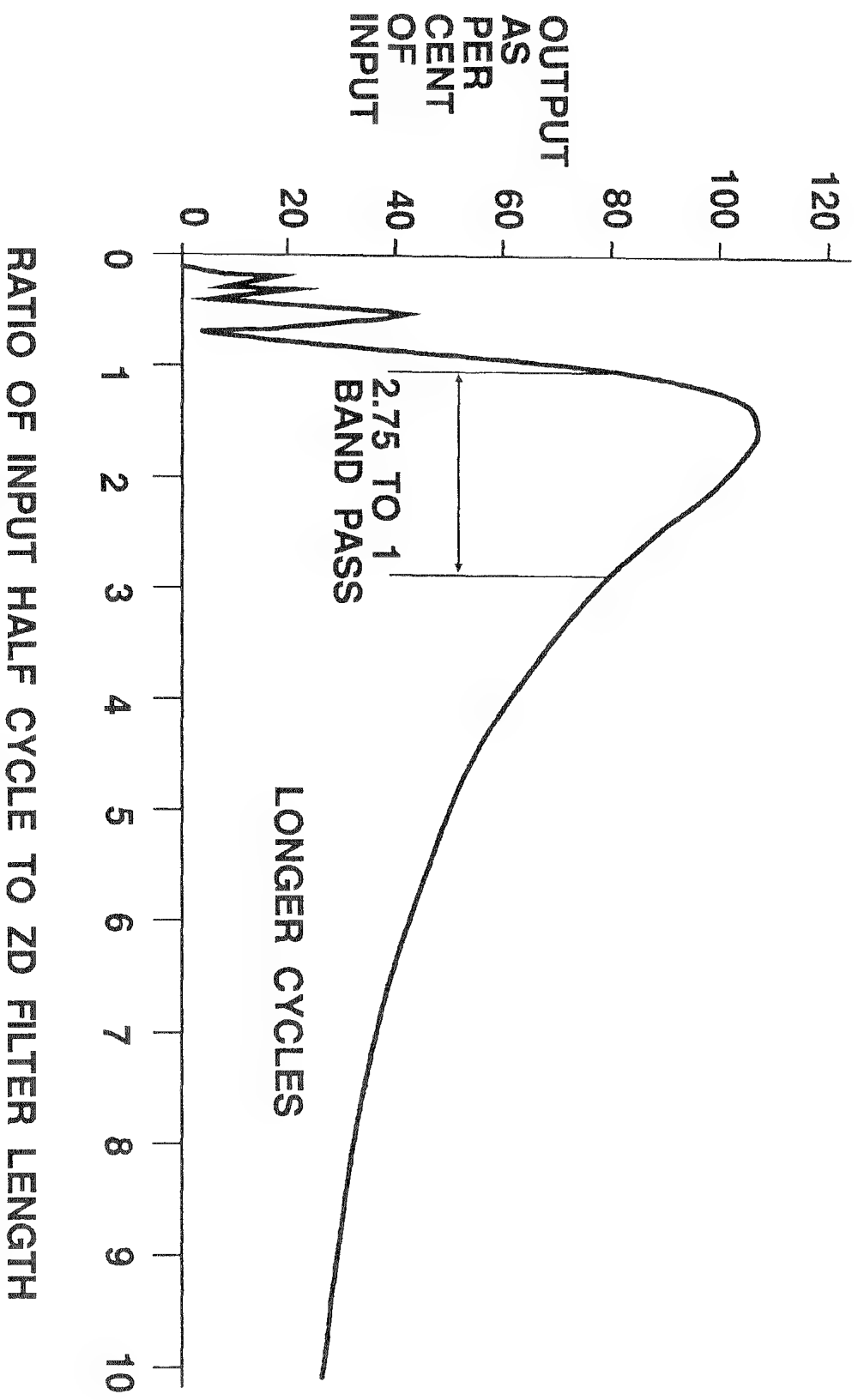
**CHAOTIC SYSTEMS MAY BE MONITORED
FOR FREQUENCY SHIFTING USING
SPECIAL FILTERS. MY**

ZERO DELAY FILTER

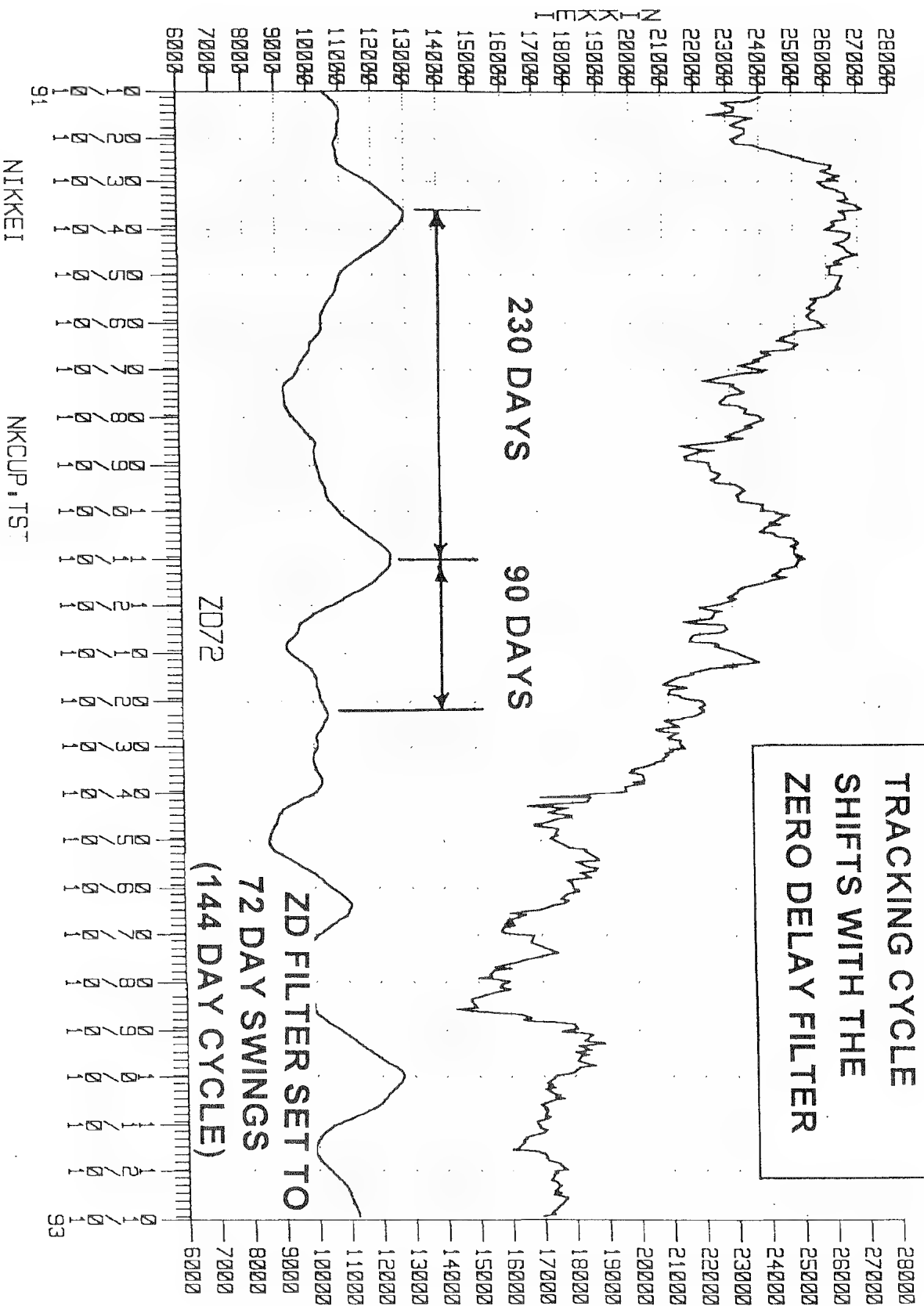
WAS DESIGNED FOR THIS PURPOSE.

THE ZD FILTER

- tracks swings, rather than cycles**
- can follow swings that vary over a 1 to 2.75 range
from an average value**
- turns down or up when the energy cycle does**



**TRACKING CYCLE
SHIFTS WITH THE
ZERO DELAY FILTER**



Fractal Dimension

FRACTAL GEOMETRY

- INVENTED BY BENOIT MANDELBROT
- FIRST NEW GEOMETRY SINCE EUCLID'S (ancient Greece)
- COMES FROM " FRACTIONAL DIMENSION "

Euclidean Geometry

- 1 D - line
- 2 D - plane or surface
- 3 D - volumes, such as cube, sphere

**BUT HOW DO YOU DESCRIBE A LINE
THAT IS "INFINITELY SQUIGGLY" ?**

GEOMETRIC DIMENSIONS

STRAIGHT LINE
 $D=1$



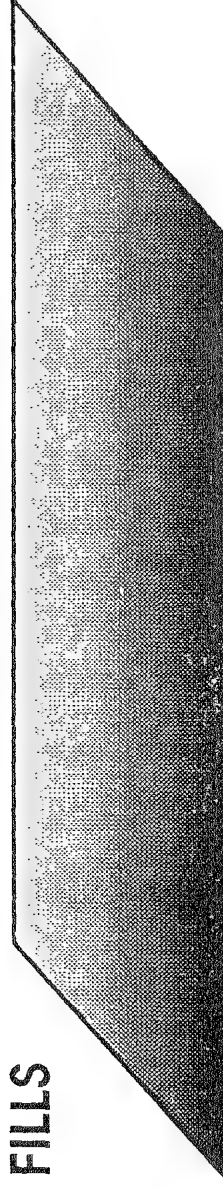
LOW SQUIGGLE
 $D=1.1$



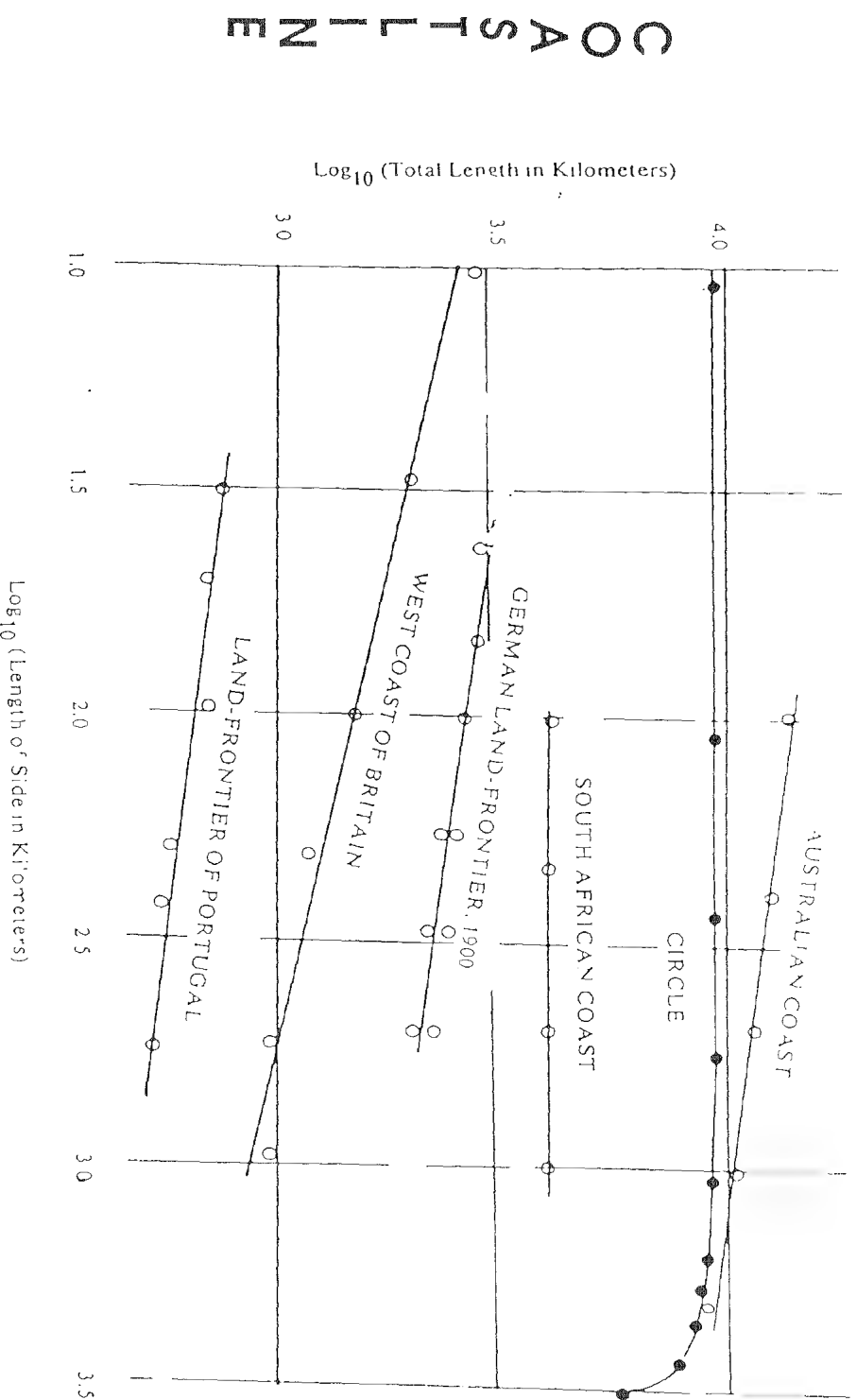
HIGH SQUIGGLE
 $D=1.6$

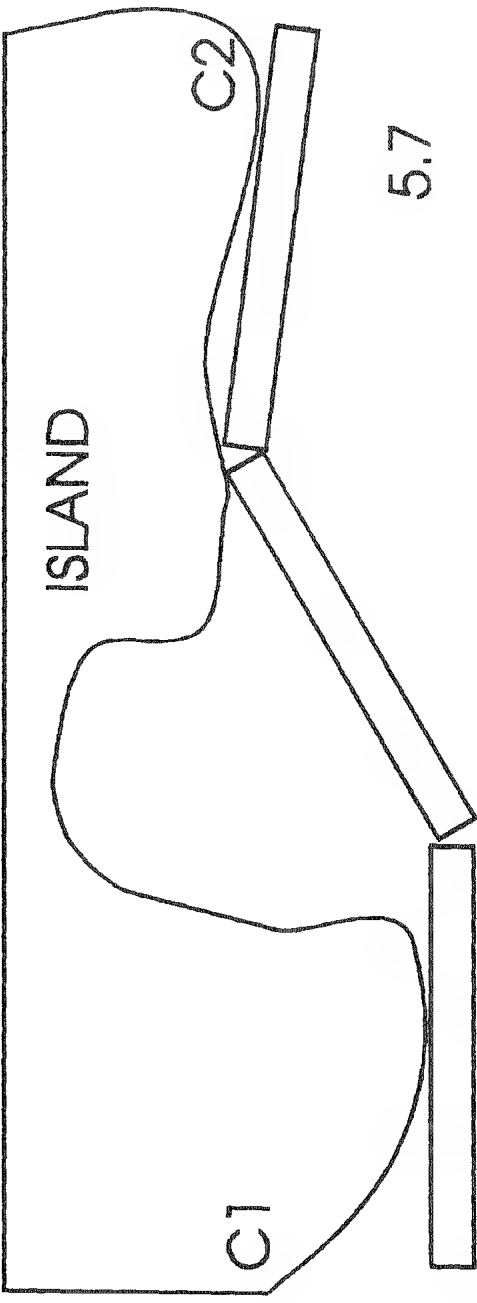
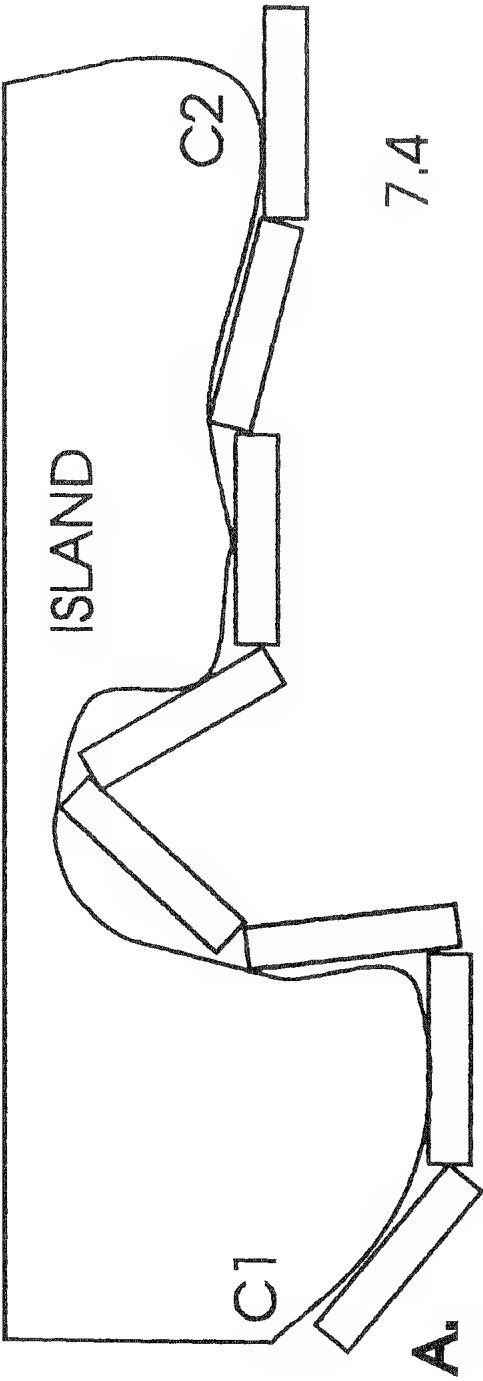


SQUIGGLE FILLS
PLANE
 $D=2$

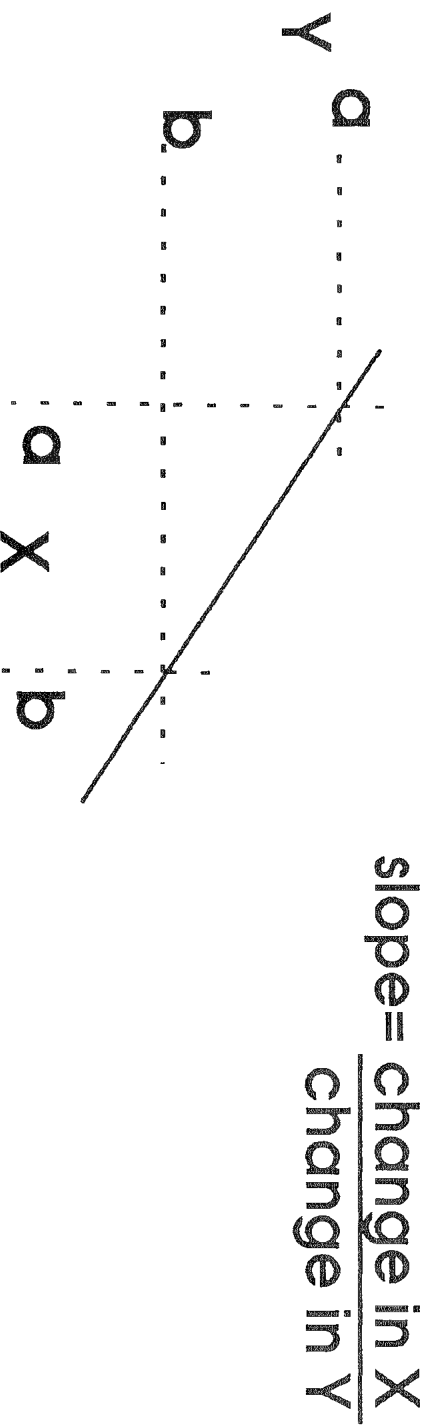


RICHARSON'S COASTLINE DATA





ALGEBRA OF THE COASTLINE DIMENSION



1-D = SLOPE OF COASTLINE ON LOG/LOG PLOT

$$1-D = \frac{\log Y_b - \log Y_a}{\log X_b - \log X_a}$$

$$D = \frac{\log Y_b - \log Y_a + 1}{\log X_b - \log X_a}$$

where: X_a is length of short ruler

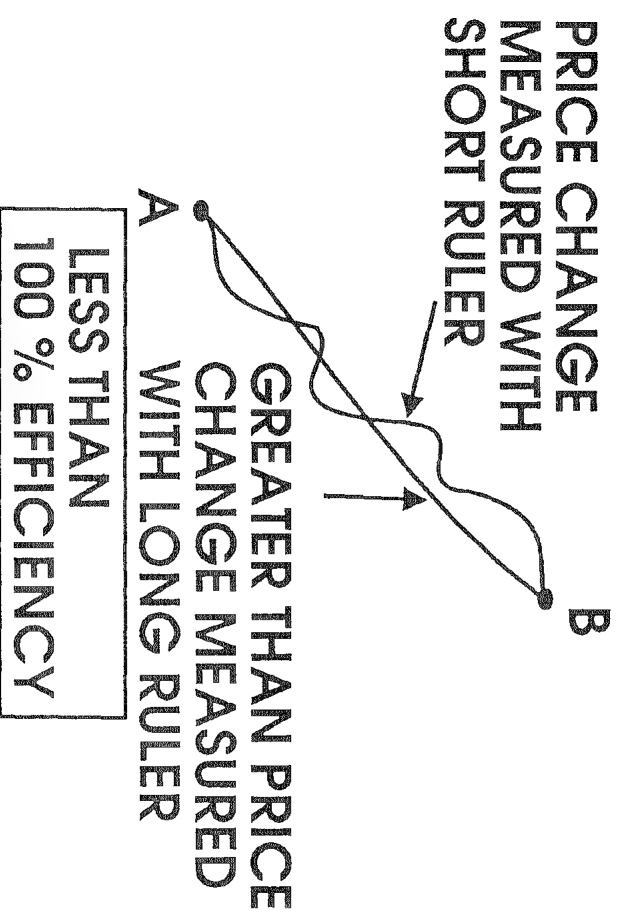
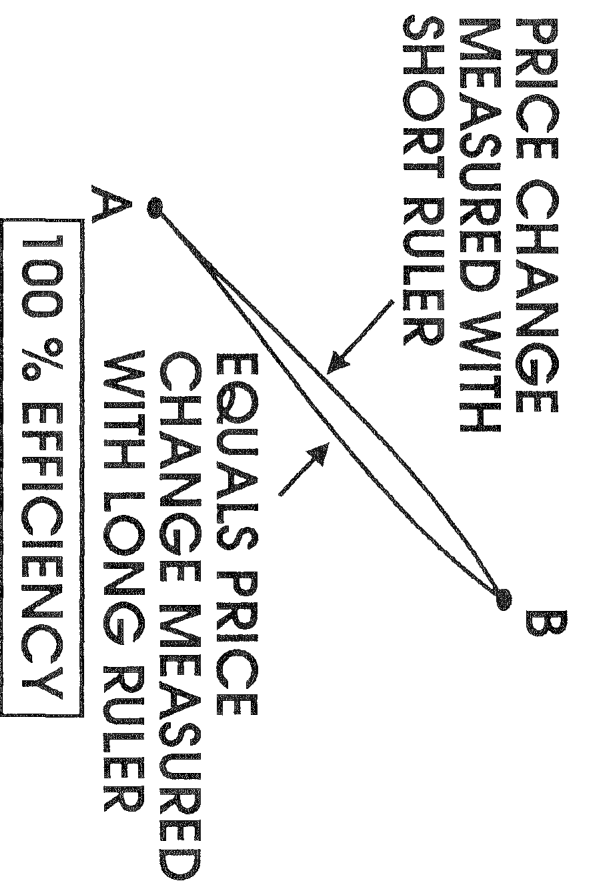
X_b is length of long ruler

Y_a is length of coast measured with short ruler

Y_b is length of coast measured with long ruler

POLARIZED FRACTAL EFFICIENCY

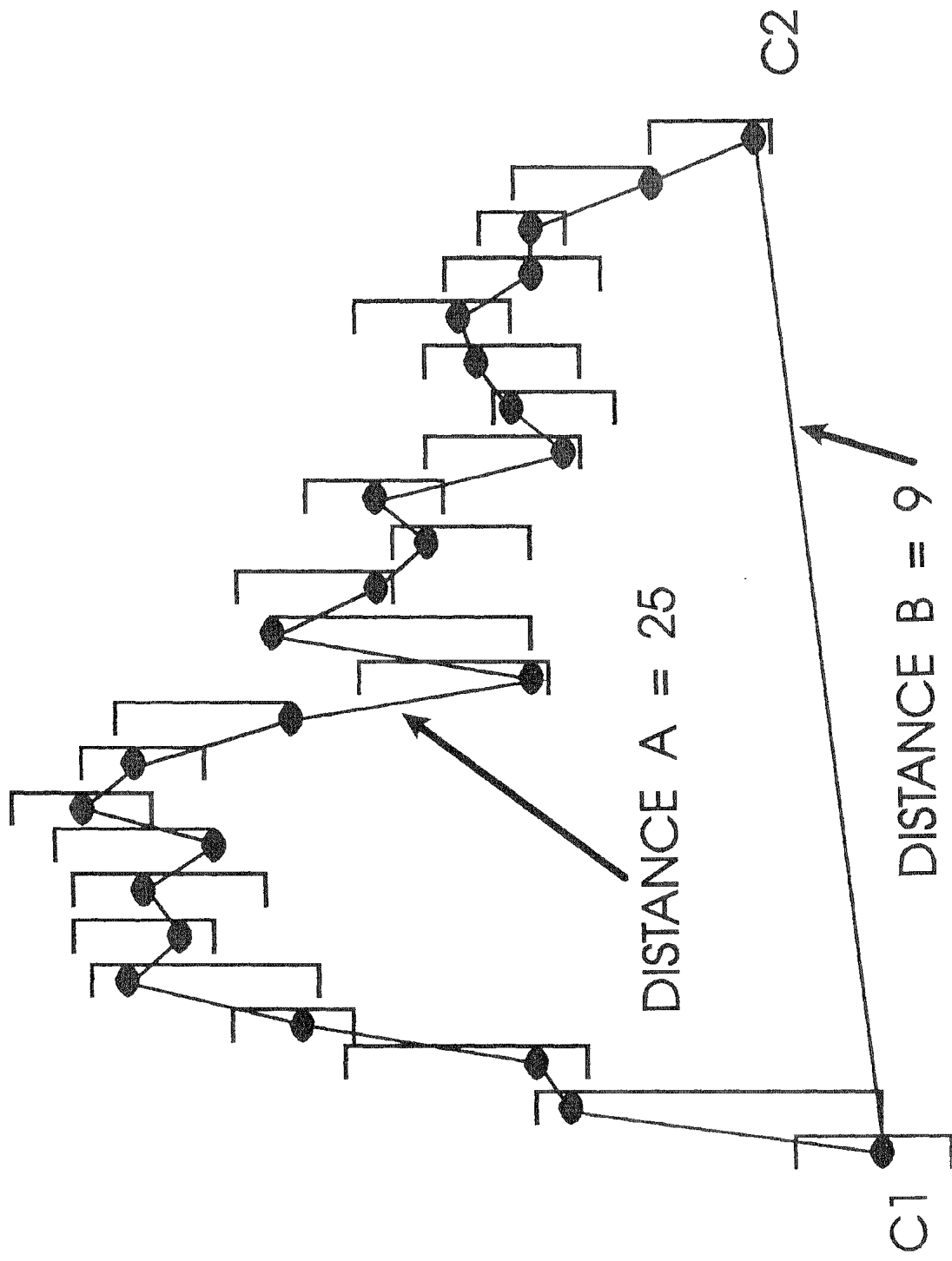
HOW EFFICIENTLY IS PRICE MOVING?



$$\text{P.F.E.} = 1/D$$

WHERE D IS THE FRACTAL DIMENSION

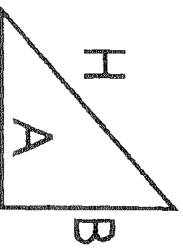
PFE IS + IF $B > A$ OR IS - IF $A > B$



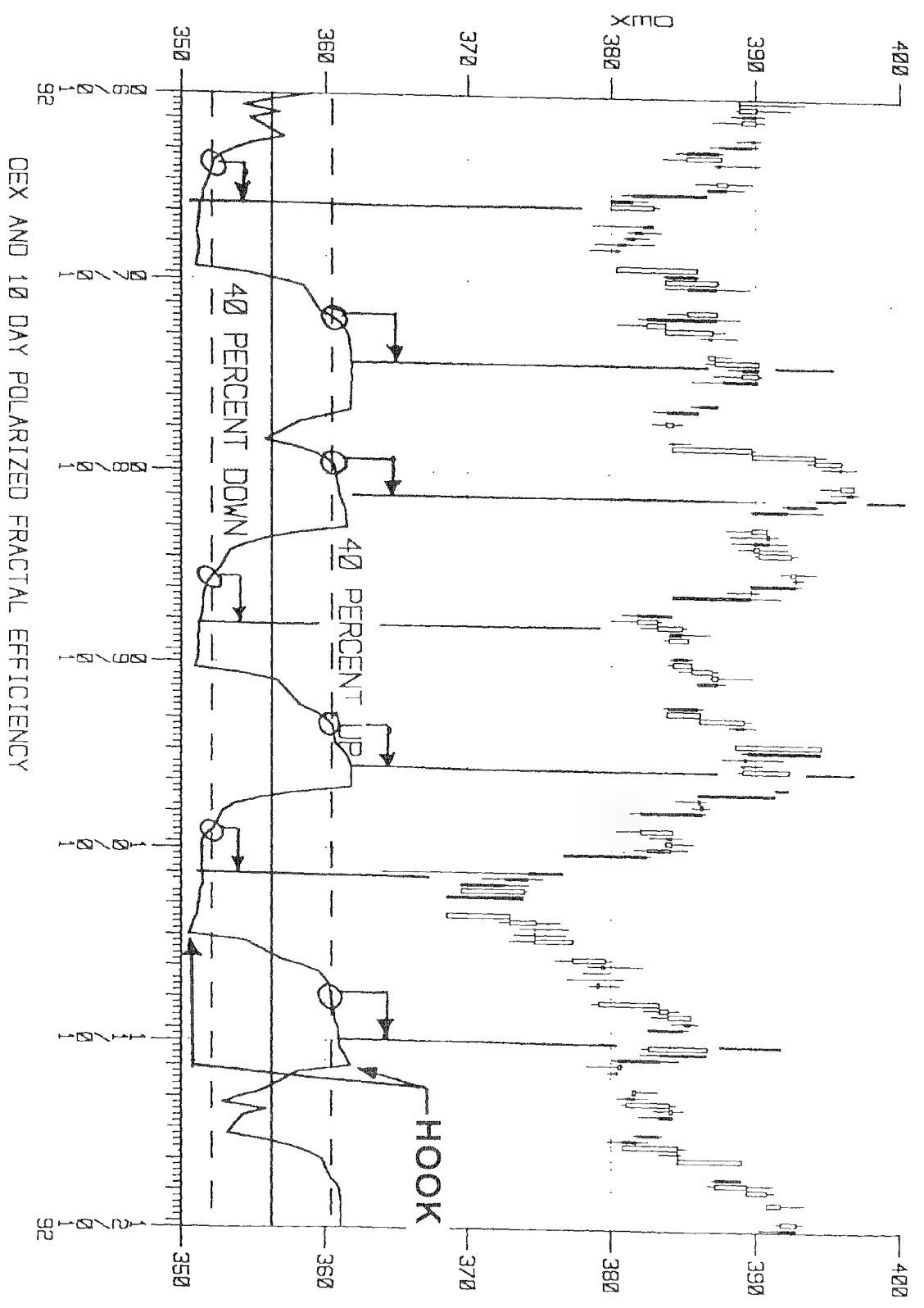
IGNORING LOGS, EFFICIENCY = $9/25 = 36\%$

$$PFE = \text{SIGN} \frac{\sqrt{(\text{CLOSE}_n - \text{CLOSE}_1)^2 + n^2}}{\sum_{i=2}^n \sqrt{(\text{CLOSE}_i - \text{CLOSE}_{i-1})^2 + 1}}$$

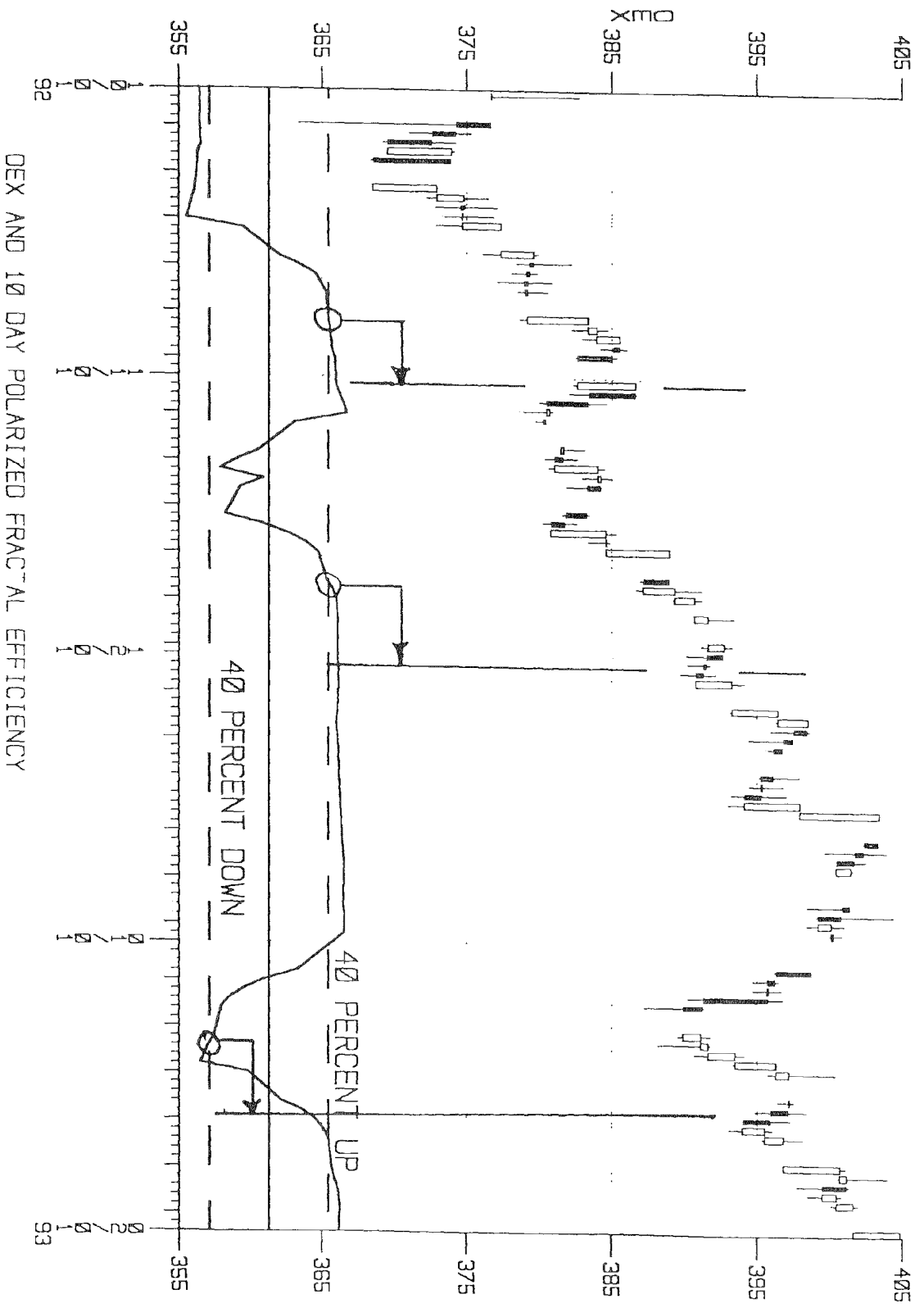
WHERE
SIGN IS PLUS IF CLOSE_n
IS HIGHER THAN CLOSE₁
AND MINUS IF CLOSE_n
IS LOWER THAN CLOSE₁



$$H = \sqrt{A^2 + B^2}$$



OEX AND 10 DAY POLARIZED FRACTAL EFFICIENCY



LISTING OF C PROGRAM TO COMPUTE PFE

```
#include <stdio.h>
#include <math.h>
double sqrt();
double log();
#define SIZE 4000
#define debug 1
/* rename as ebug to turn on prints */
#define P1 3.1415926535
int month[SIZE],day[SIZE],year[SIZE];
double data[SIZE];
double volume,high,low;
main(argc,argv)
int argc;
char *argv[];
{
    double ave;
    double avedate;
    int npts;
    int nread;
    int start,end; /* starting and ending indexes */
    int mid; /* mid index */
    int i,j;
    FILE *fp,*fpout,*fopen();
    int done;
    double A,B,C,D,E,F;
    double lastave;
    double diff;
    if (argc < 4) /* no args, error and quit */
    {
        printf ("\n usage: fracdinh filein fileout number_of_points\rdata in .hic format\n");
        exit(1);
    }
}
```



```

else
    if ((fp = fopen(argv[1], "r")) == NULL) {
        fprintf(stderr,
            "fracdimh: can't open %s\n", argv[1]);
        exit(1);
    }
    if ((fpout = fopen(argv[2], "w")) == NULL) {
        fprintf(stderr,
            "fracdimh: can't open %s\n", argv[1]);
        exit(1);
    }
    npts=atoi(argv[3]);
    #ifdef ebug
        printf("\n npts= %d", npts);
    #endif
    /* fill initial array */
    for(i=0; i<npts; i++){
        done=fscanf(fp, "%d%d%d%d%f%f%f", &month[i], &day[i], &year[i], &volume, &high, &low, &data[i]);
        if(done<7)exit(1);
    }
    #ifdef ebug
        printf("\n date[%d] = %2d %2d %2d , data[%d]= %f", i, month[i], day[i], year[i], data[i]);
    #endif
}
/* set up initial indexes */
start=0;
end= npts-1;
while(1){
    /* compute the straight line distance */
    A=sqrt( end*end + (data[end]-data[start])*(data[end]-data[start]) );
    /* now compute crooked distance */
    B=0;
    for(i=start; i<end; i++)
    {
        D=data[i+1]-data[i];

```

```

        B=B+sqrt( 1.0 + D*D );

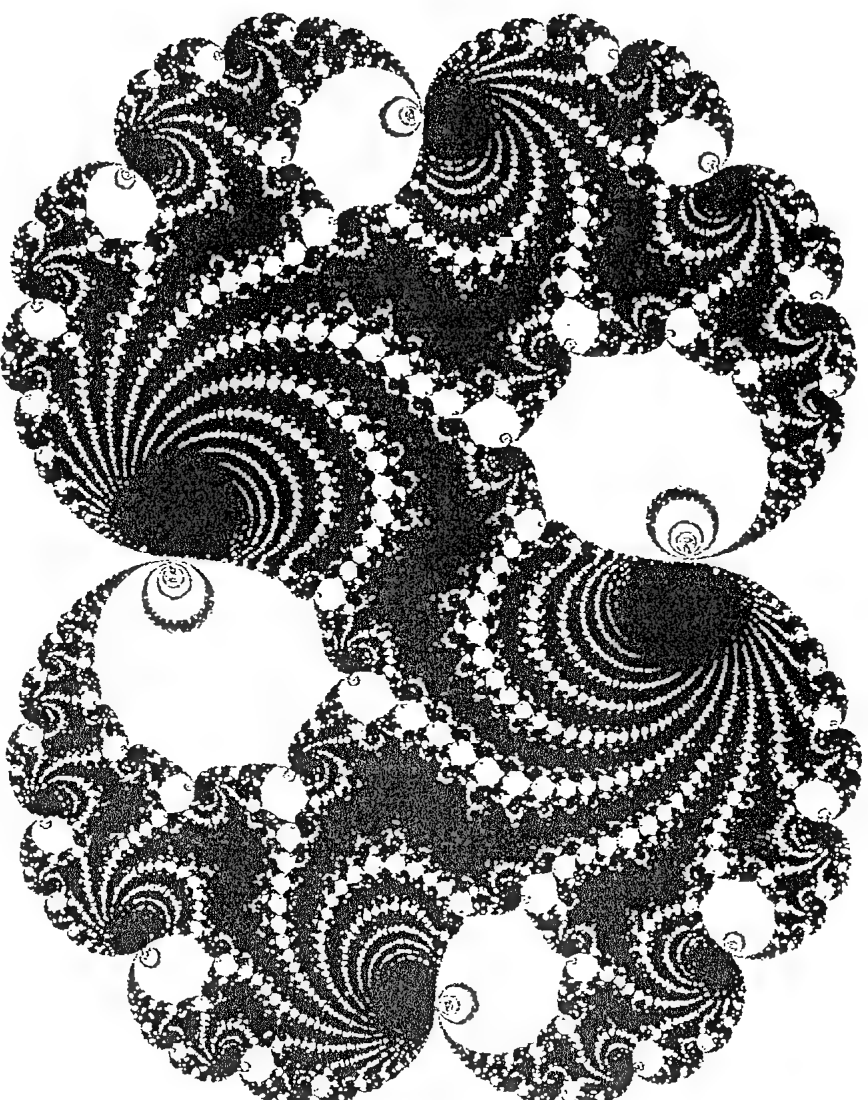
#ifdef ebug
    printf("\n i=%d data[i+1]=%f data[j]=%f D=%f B=%f", i, data[i+1], data[j], D, B);
#endif
    }
    /* compute the normalized fractal dimension */
    C=A/B;
    D=1.0 + ( ( log(B) -log(A) ) / log ( (double) (npts) ) );
    if(data[end] < data[start]) D= -D ;

#ifdef ebug
    printf("\n A= %f",A);
    printf("\n B= %f",B);
    printf("\n C= %f",C);
    printf("\n D= %f",D);
#endif
    fprintf(fpout, "\n%2d %2d %4d %9.3f", month[end], day[end], year[end], D);
    /* now push the data down */
    {
        data[j]=data[i+1];
        month[j]=month[i+1];
        day[j]=day[i+1];
        year[j]=year[i+1];
    }
    /* now add the new point */
    done=fscanf(fp, "%d%d%d%f%f%f", &month[end], &day[end], &year[end], &volume, &high, &low, &data[end]);
    if(done<7)exit(1);
    lastave=ave;
}
}

```

Fractal Patterns

FRACTAL PATTERNS ARE GENERATED BY ITERATED FUNCTIONS



from p. 191, THE FRACTAL GEOMETRY OF NATURE, Mandelbrot

GENERATING A FRACTAL SET BY ALGEBRAIC ITERATED FUNCTIONS

$$f(n) = X_{n+1} = A X_n (1 - X_n) \quad \text{for } X \text{ between 0 and 1}$$

starting with $X = 1.5$ and using $A = .5$ (step 0)

$$\text{step 1: } X_1 = .5 \times 1.5 \times (1 - 1.5) = .5 \times 1.5 \times (-.5) = -.375$$

$$\text{step 2: } X_2 = .5 \times (-.375) \times (1 - -.375) = -(.5 \times .375 \times 1.375) = \underline{\hspace{1cm}}$$

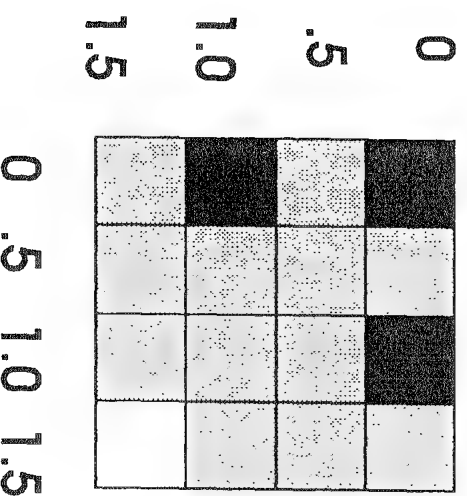
$$\text{step 3: etc.} \quad \underbrace{\hspace{1cm}}_{1.375}$$

This sequence of numbers is called the "orbit" of the function.
This orbit ends up at different places depending on the starting value.

What happens if we start at $X=1.0$? X greater than 1?
 X less than 1?

HOW TO CREATE THOSE MAGIC FRACTAL PICTURES

1. USE TWO ITERATED FUNCTIONS
ONE FOR HORIZONTAL (X) AND
ONE FOR VERTICAL (Y)
2. DIVIDE SURFACE INTO AN X-Y GRID OF STARTING VALUES
3. COMPUTE ORBITS FOR EACH GRID SQUARE
4. COLOR GRID ACCORDING TO SOME FINAL VALUE RULES



USING EXAMPLE FUNCTION,
WITH A=2 FOR X AND Y DIRECTIONS

AND RULES

BOTH X AND Y-> 0 , BLACK
BOTH X ANY Y -> +/- BIG, WHITE
OTHERWISE GREY

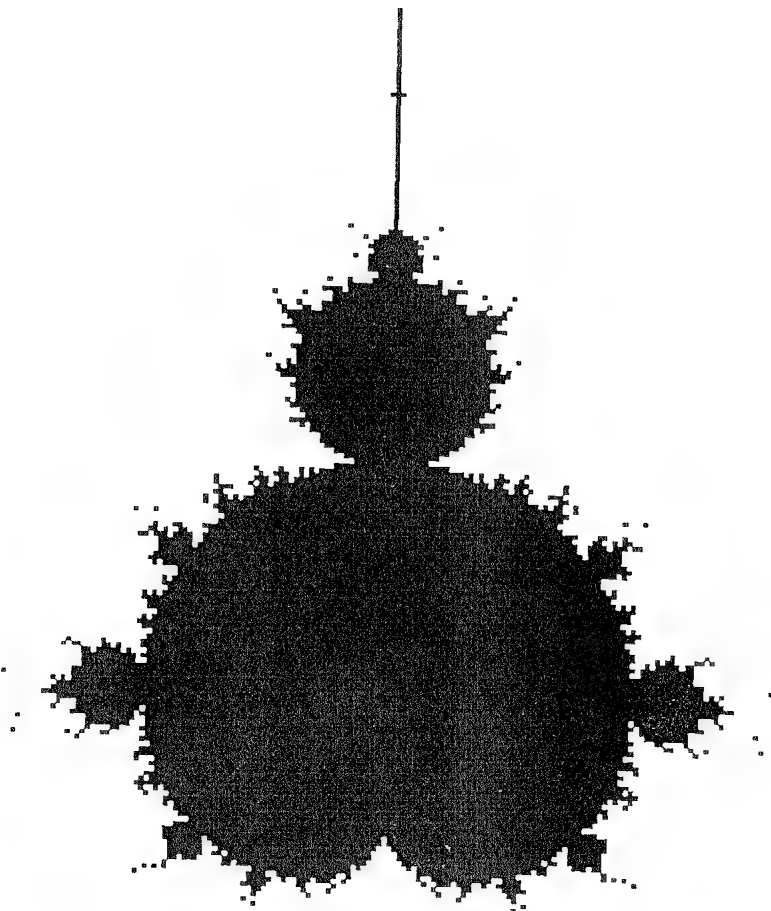
0.0 -> 0
.5 -> .5
1.0 -> 0
1.5 -> -BIG

5. NAME IT AFTER YOURSELF, CALL IT A SET, AND BECOME FAMOUS

A MANDELBROT SET CREATED THIS WAY

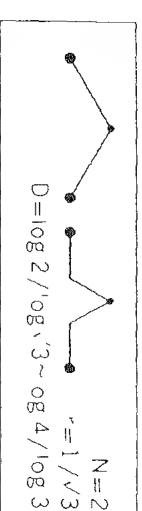
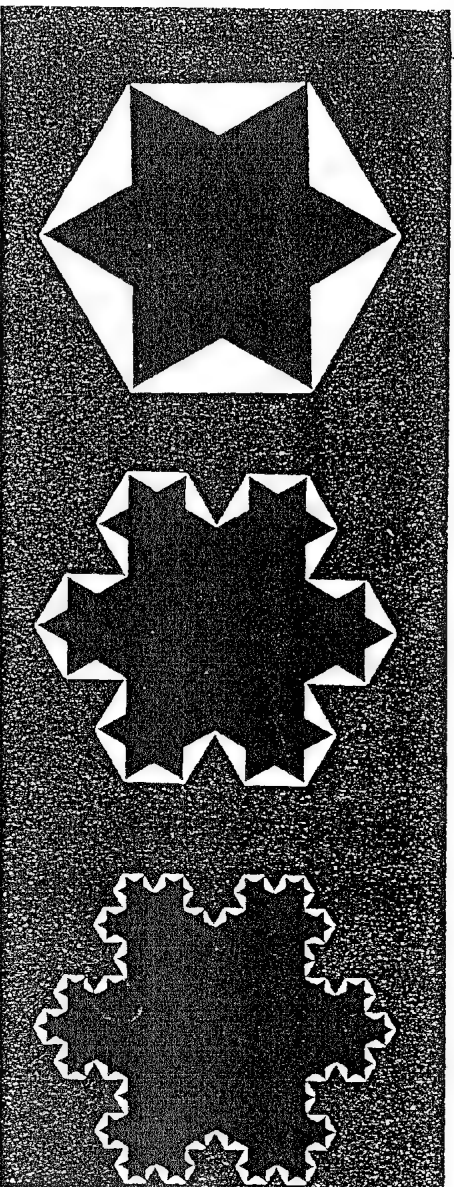
BASIC PROGRAM, p. 117

```
REM program MANDELBROT1
CLS
FOR i=1 TO 300
  FOR j=1 TO 150
    c1 = -2+4*i/300
    c2 = 2-4*j/300
    x=c1
    y=c2
    FOR n=1 TO 30
      x1=x*x-y*y+c1
      y1=2*x*y+c2
      r=x1*x1+y1*y1
      IF r>4 THEN GOTO 1000
      x=x1
      y=y1
    NEXT n
    PSET(i,j)
  PSET(i,300-j)
1000 NEXT j
NEXT i
END
```



after Devaney, CHAOS, FRACTALS, AND DYNAMICS,
COMPUTER EXPERIMENTS IN MATHEMATICS, p. 115

GENERATING A FRACTAL SET GEOMETRICALLY



INITIATOR GENERATOR

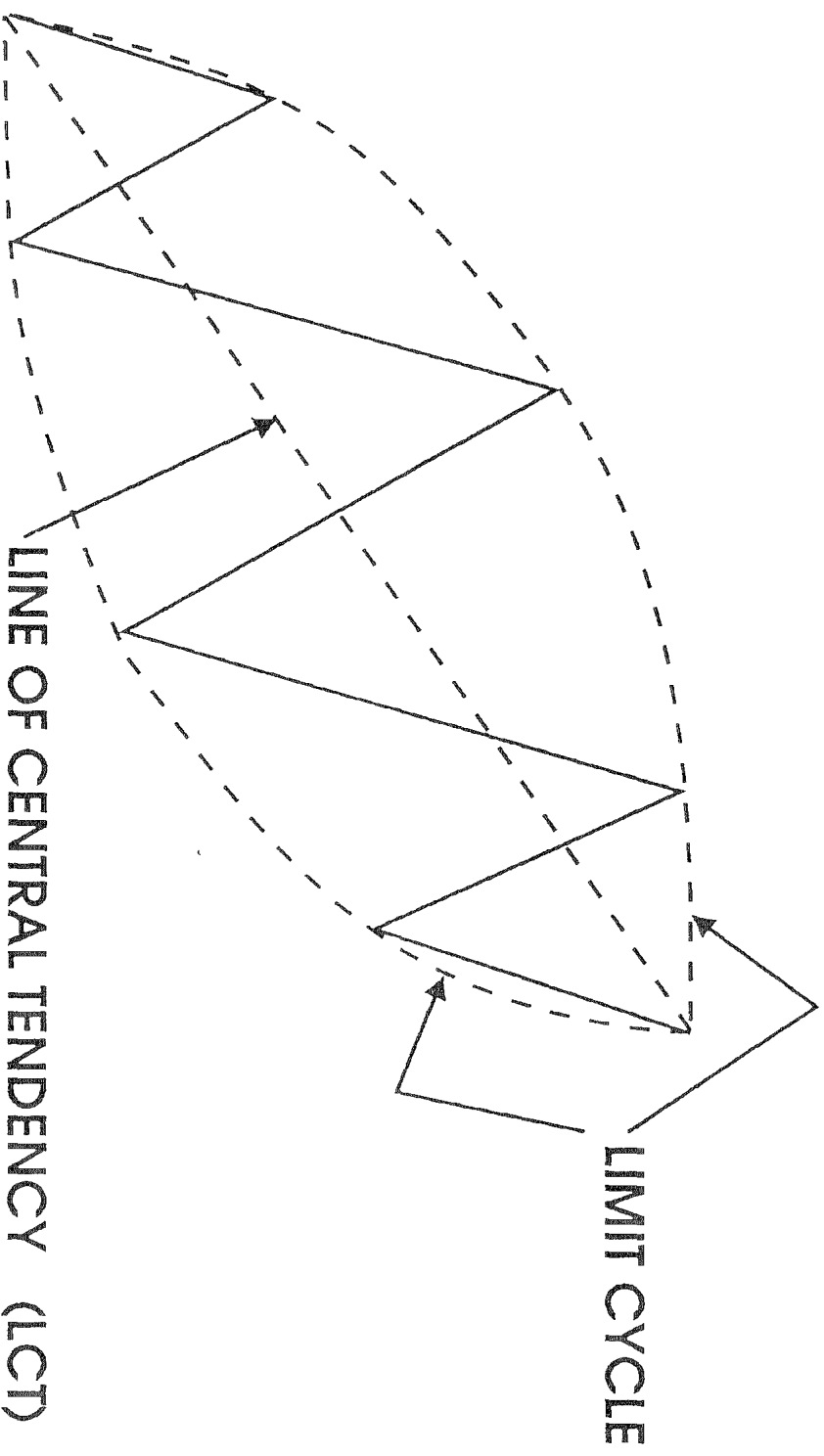
Plate 43 ■ TRIADIC KOCH ISLAND OR SNOWFLAKE . K. ALTERNATIVE CONSTRUCTION
BY ERNEST CESÀRO (COASTLINE DIMENSION $D = \log 4 / \log 3 \sim 1.2618$)

1. TAKE INITIATOR
2. REPLACE EACH LINE SEGMENT IN PATTERN BY GENERATOR, SCALING AS NEEDED
3. REPEAT 2 FOR n STEPS

after Mandelbrot, THE FRACTAL GEOMETRY OF NATURE, p. 43

The Hannula Market Fractal

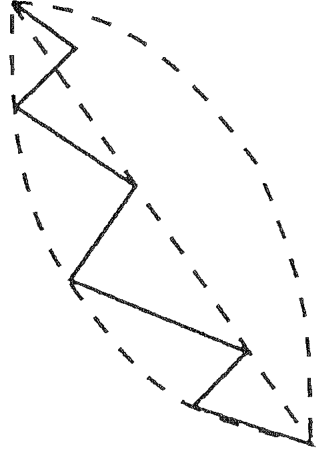
THE HANNULA MARKET FRACTAL SET



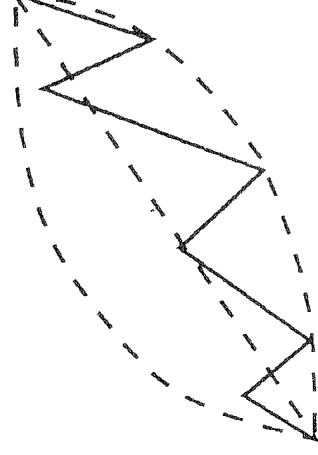
© 1992 Dr. Hans Hannula
may not be reproduced.

INITIATOR GENERATOR

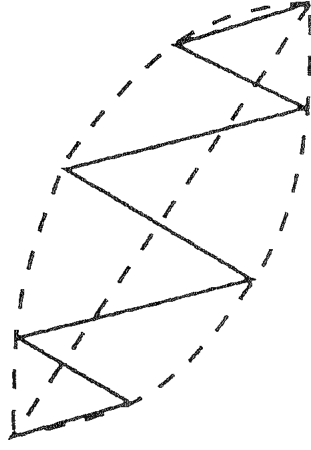
VARIATIONS OF THE HANNULA MARKET FRACTAL SET



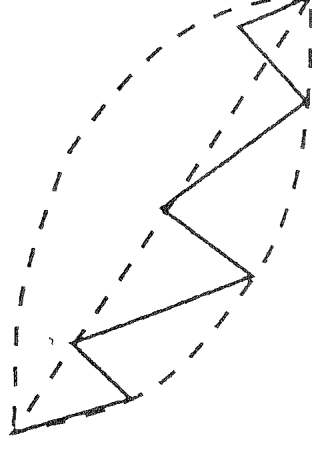
UP TOP



UP BOTTOM



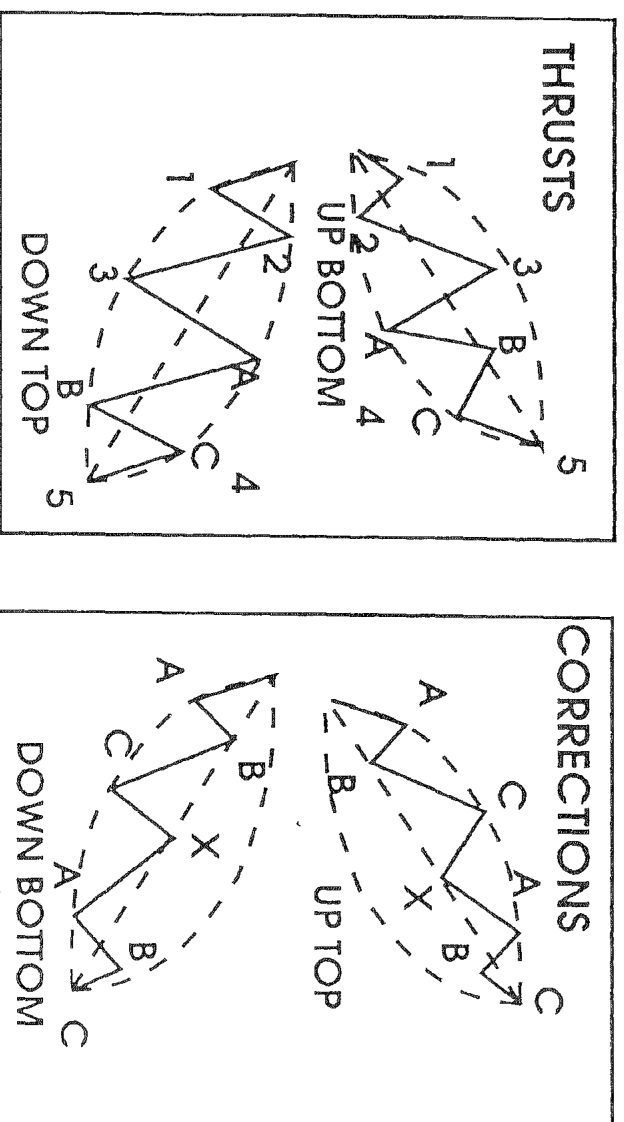
DOWN TOP



DOWN BOTTOM

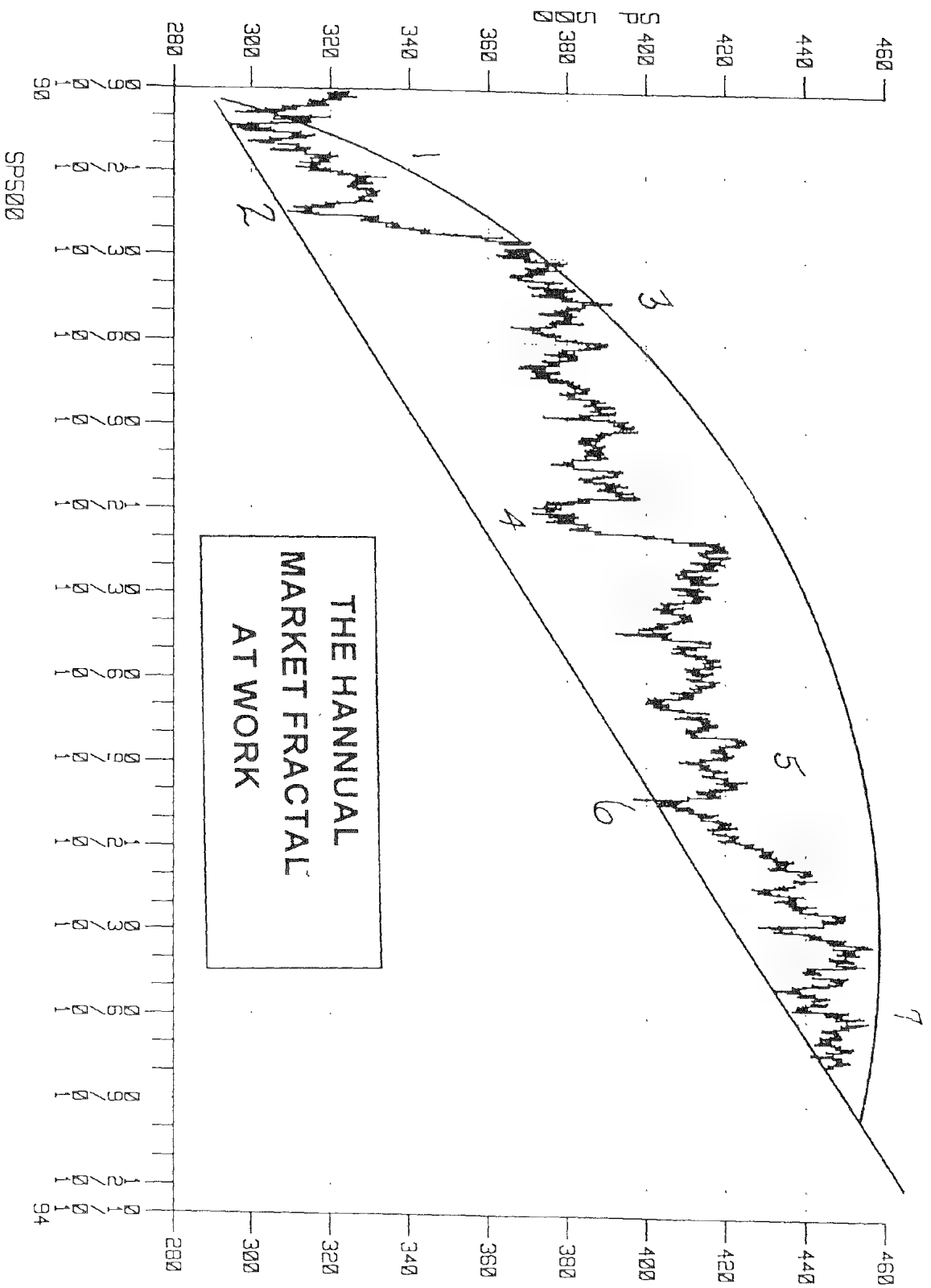
THE HANNULA MARKET FRACTAL SET

1. UNDERLIES ALL MARKET MOVES
2. WORKS ON ANY TIME SCALE
3. IS BASED ON THE PHYSICS OF NATURAL CYCLES
4. IS ONE PATTERN, UP OR DOWN, OF 7 ARGUABLE MOVES
5. UNDERLIES ELLIOTT WAVES

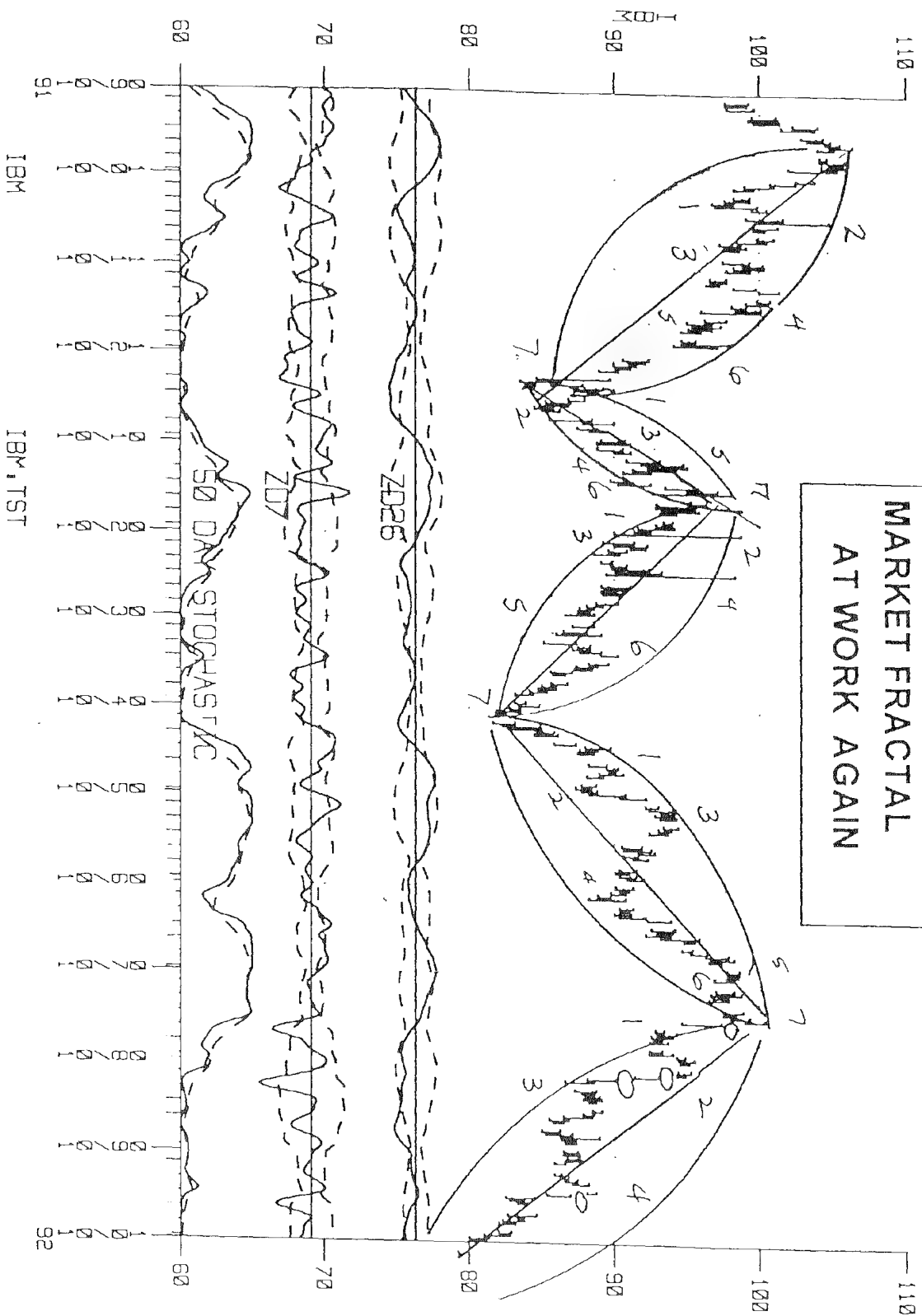


SIMPLIFY !

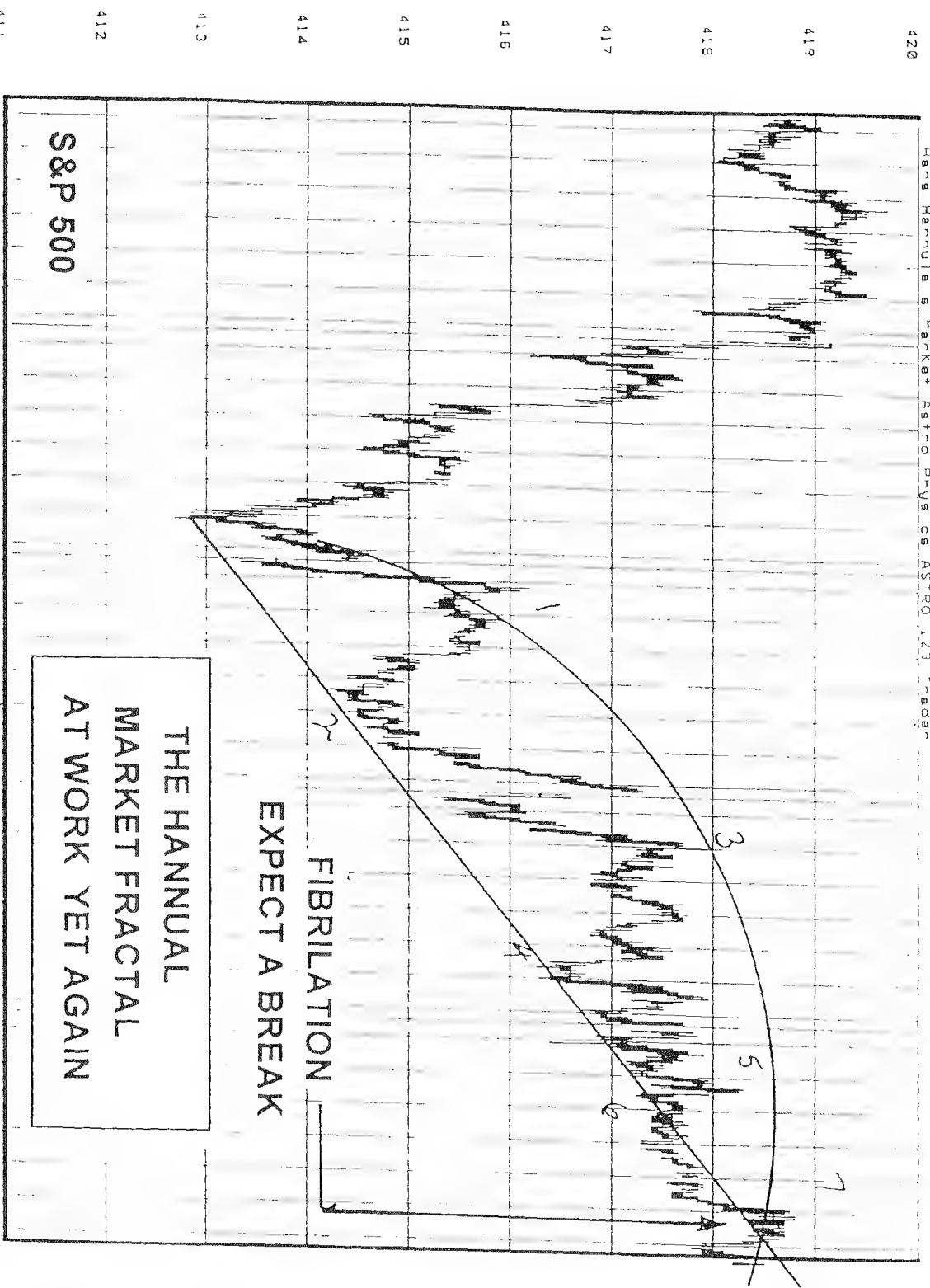
1. FIND LIMIT CYCLES
2. FIND LCT
3. LOOK FOR 7 MOVES

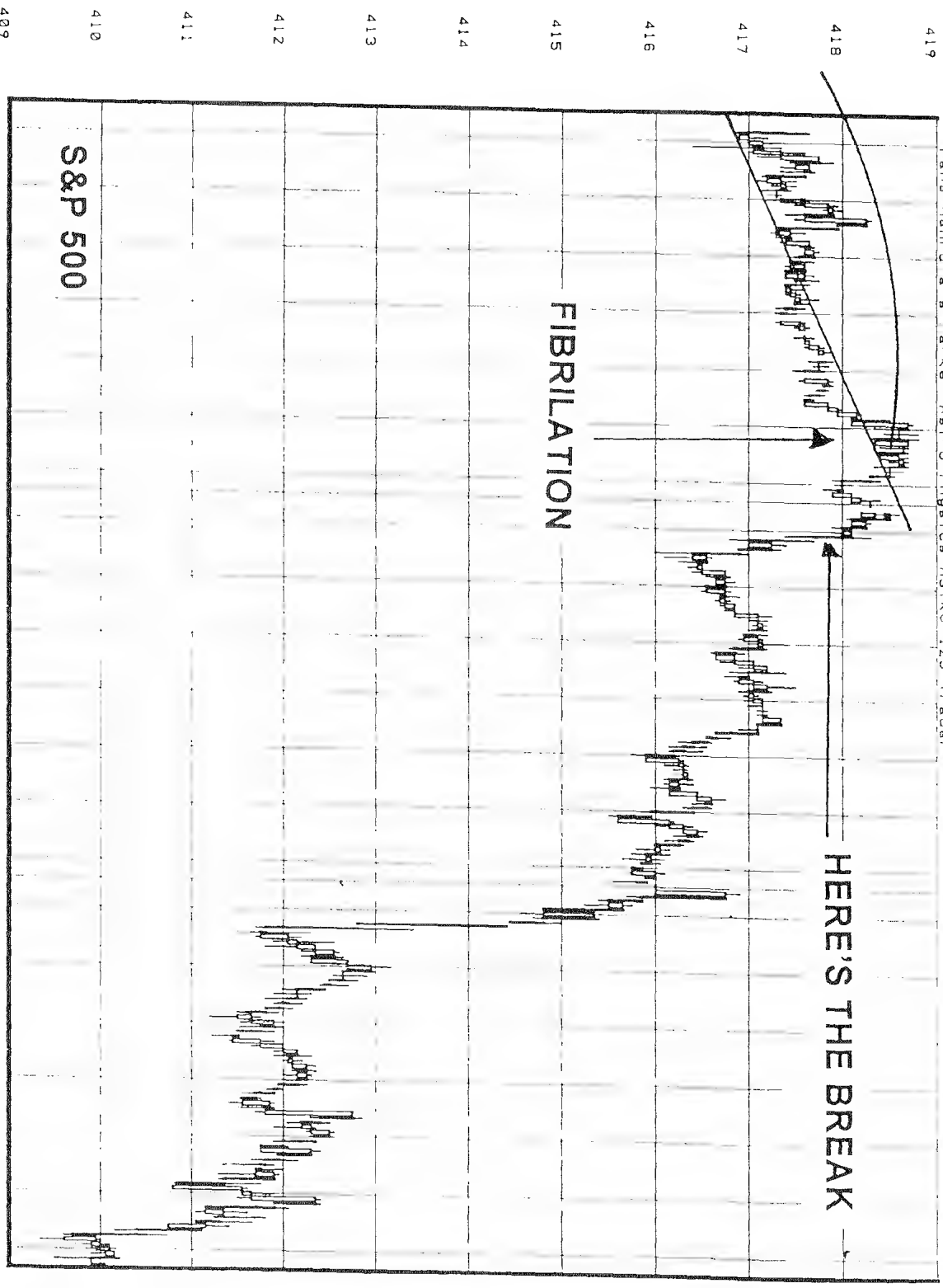


THE HANNUAL MARKET FRACTAL AT WORK AGAIN



Hers Hancula's Market Astro Plus CS Astro 1.23 Trade





THE HANNULA MARKET FRACTAL SET

SKETCHING PROCEDURE

1. CIRCLE HIGHEST HIGH AND LOWEST LOW
2. DRAW LINE BETWEEN THEM AS L. C. T.
3. SKETCH BOTH LIMIT CYCLES
4. DIVIDE "FOOTBALL" IN HALF TO HELP FIND THE 7 MOVES
5. SKETCH IN THE MOVES

420

415

410

405

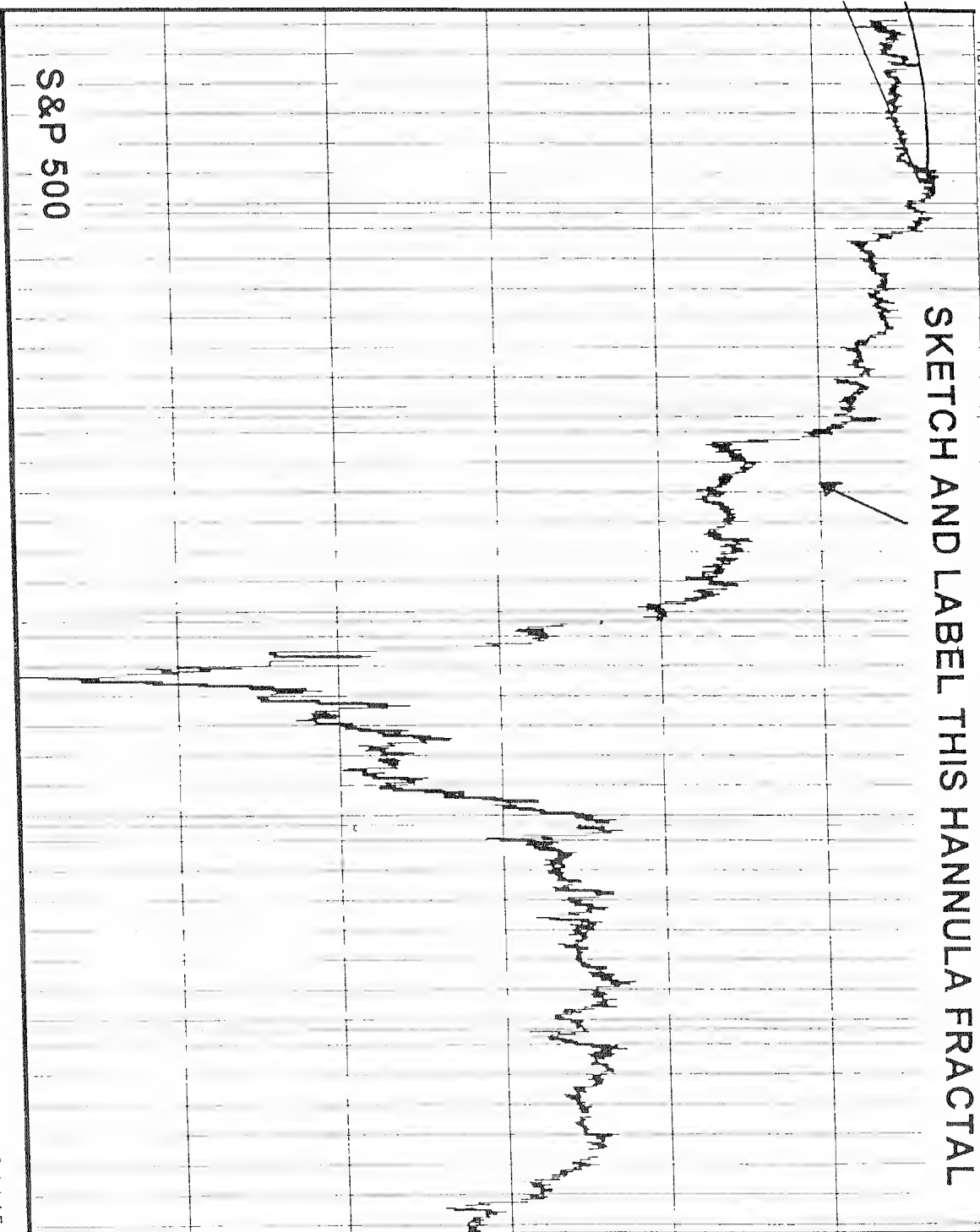
400

395

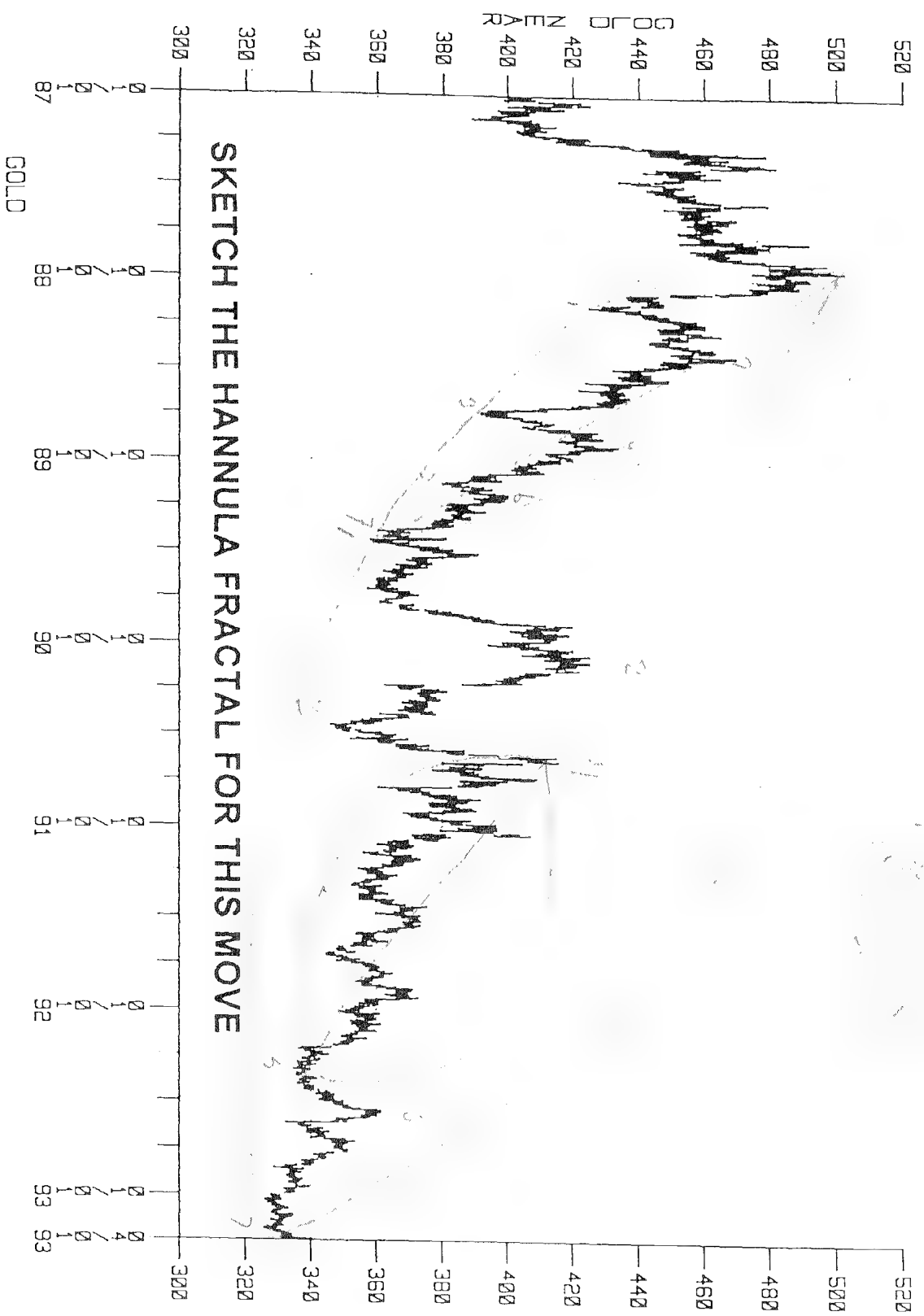
390

Hannu's Market Astro Physics ASTRO 123 "rader"

SKETCH AND LABEL THIS HANNULA FRACTAL



10 11 12 13 14 15 16 10 11 12 13 14 15 16 10 11 12 13 14 15 16 10 11 12 13 14 15 16
9/30 10/1 10/2 10/5 10/6 10/7



457

Hans Hannula's Market Astro Phys cs ASTRO 123 Trader

456

SKETCH THE HANNULA FRACTAL FOR THIS MOVE

455

454

453

452

451

450

449

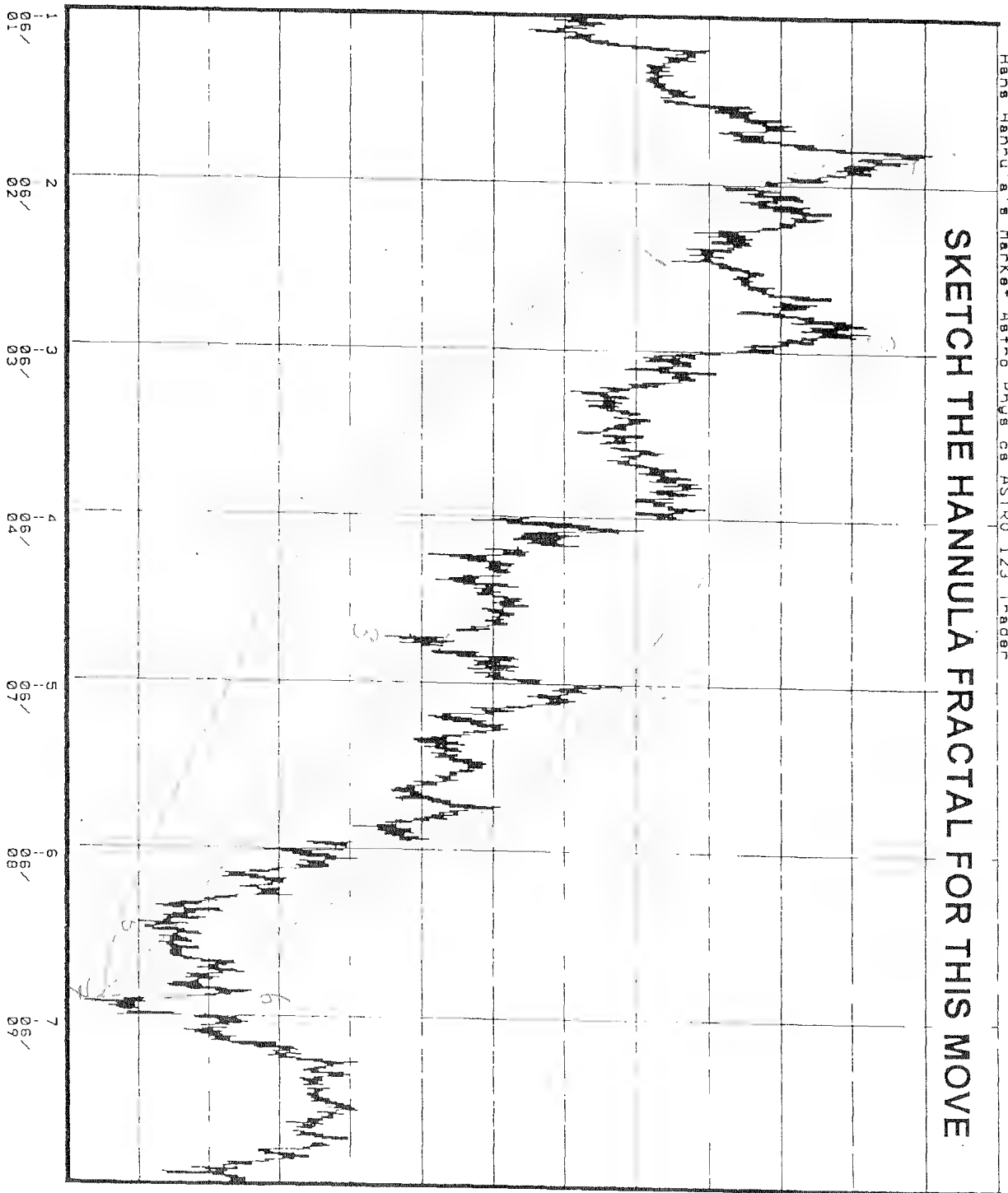
448

447

446

445

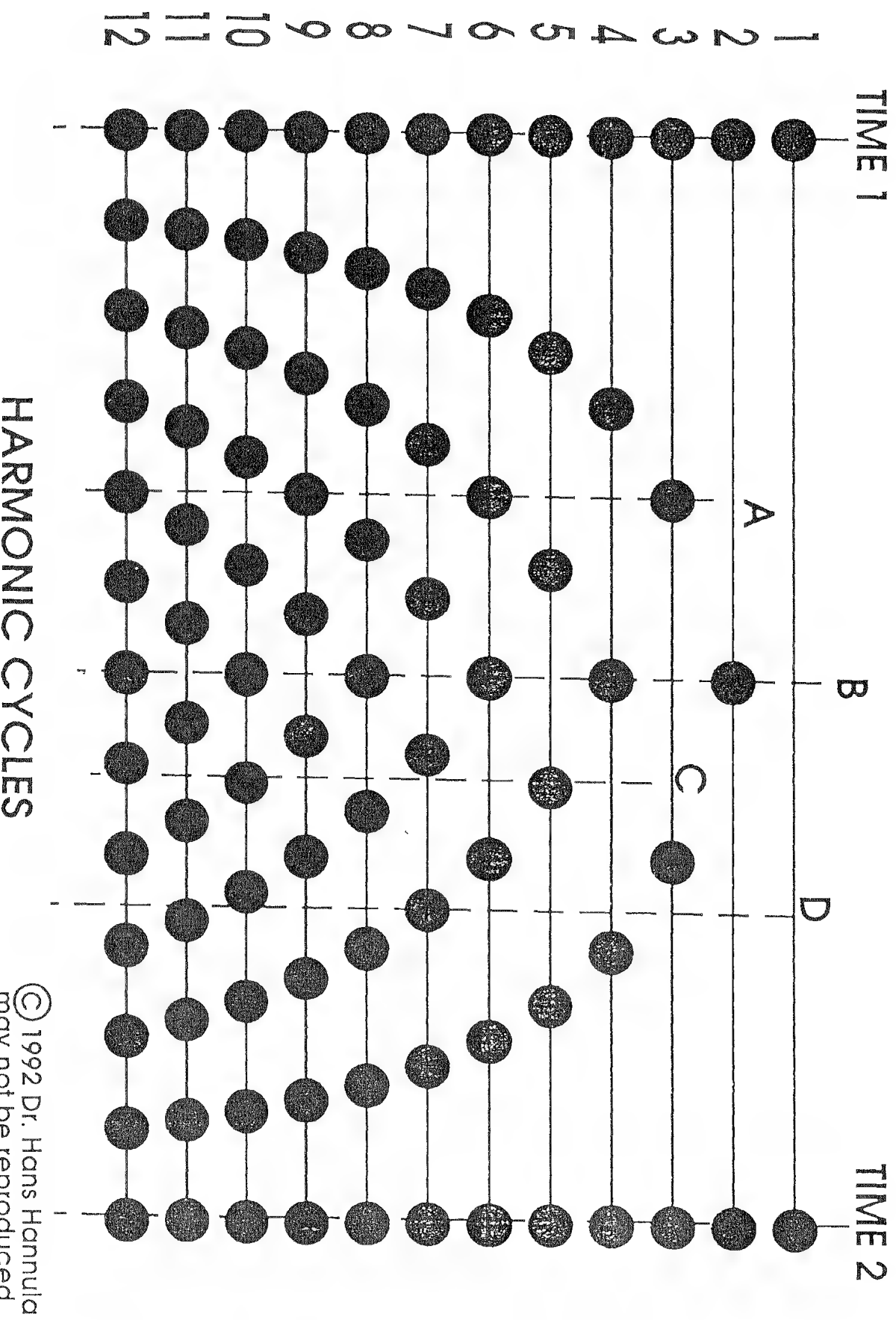
444



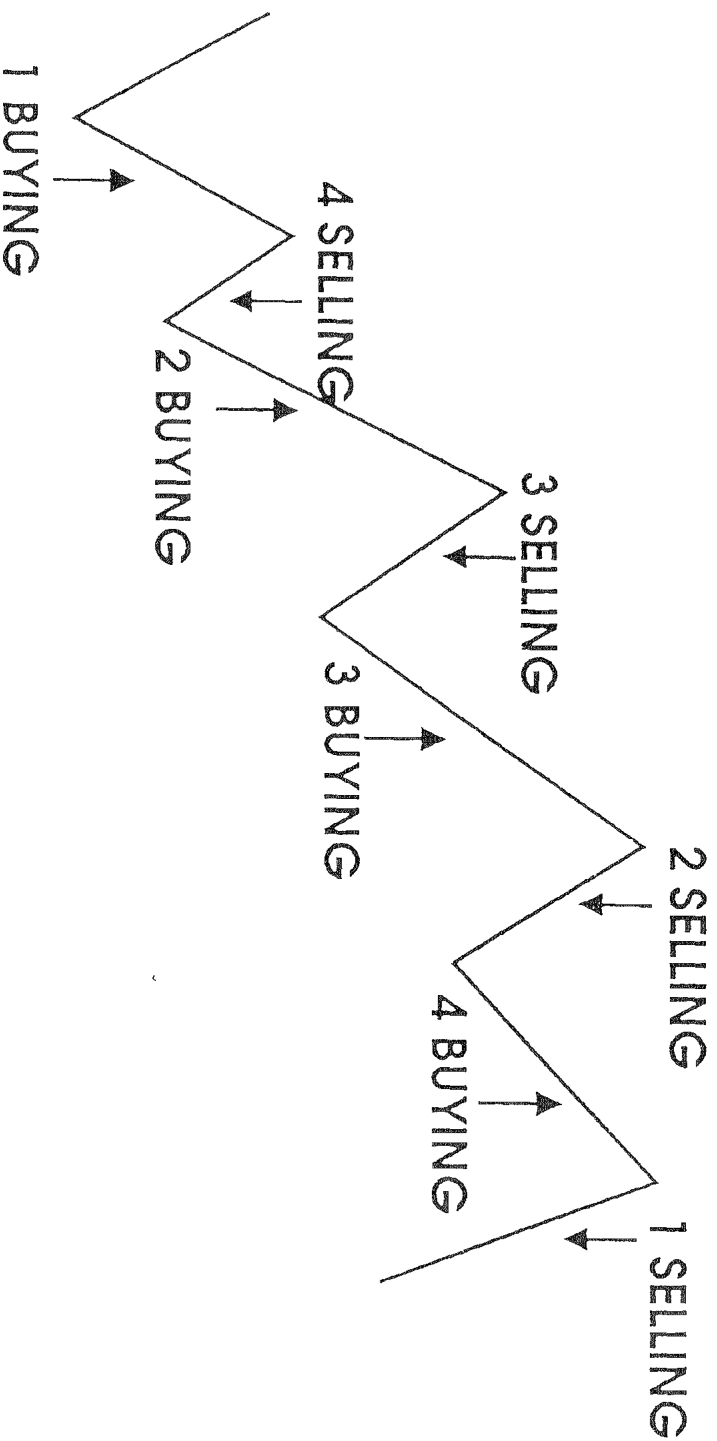
S&P 500 NEAR

DOTODAV1

WHY ARE THERE 7 MOVES?



BUYERS AND SELLERS IN THE FRACTAL



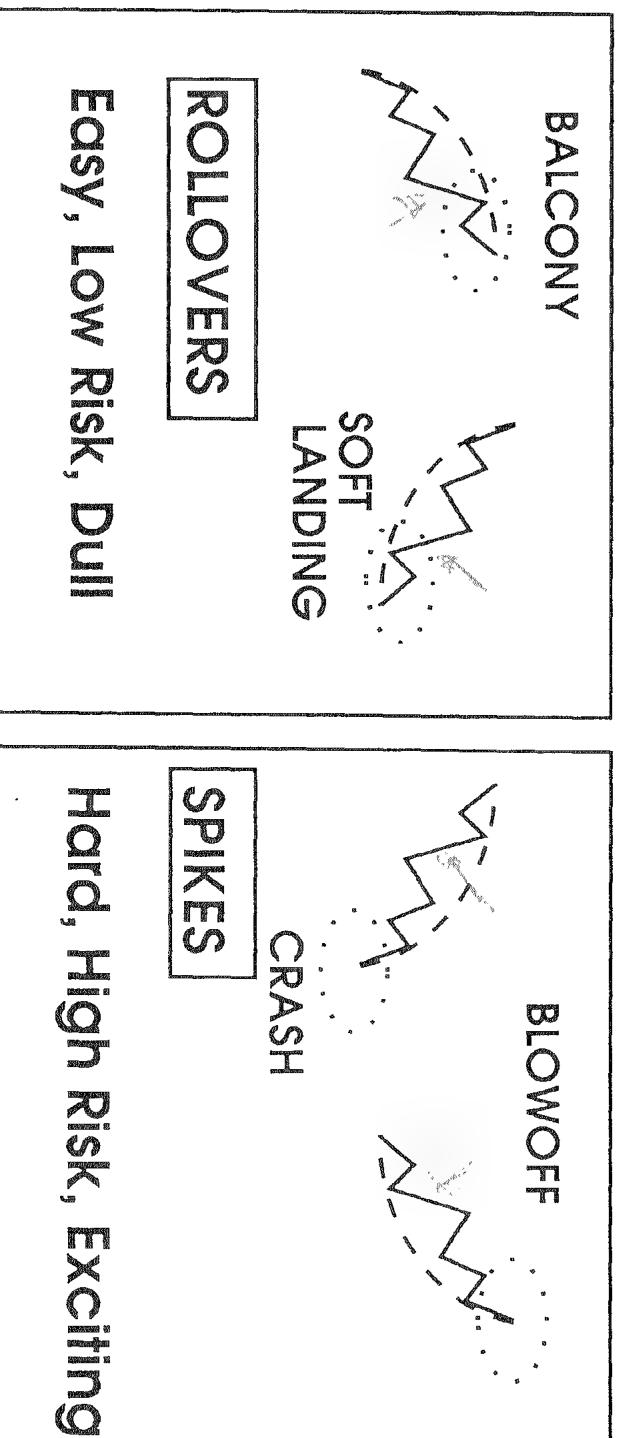
4 GROUPS

1. REAL PROS - WIN BIG
2. SEMI PROS - WIN SOME
3. SERIOUS AMATUERS - LOSE SOME
4. RANK AMATUERS - LOSE BIG

Trading Examples

THE SECRET OF MAKING MONEY IS

1. KNOWING THAT A FRACTAL HAS BEGUN
2. PROJECTING THE FRACTAL IN ADVANCE
3. UPDATING PROJECTION AS FRACTAL DEVELOPS
4. TRADE EARLY, LATE, OR MIDDLE OF FRACTAL



455

1. FIND END OF PRIOR FRACTAL

4. PLACE PROTECTIVE STOP AND REVERSE
ABOVE FRACTAL BASE

450

5. AS FRACTAL DEVELOPS,
MOVE SAR DOWN
ABOVE THE LIMIT CYCLE

445

3. ENTER ON STOP
BELOW THE HOOK

6. BE READY TO MOVE
SAR FAST ON CLIMAX

440

2. WAIT FOR HANNULA HOOK

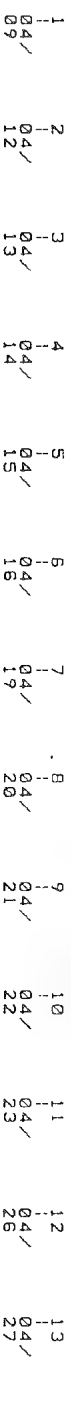
7. GRAB THE
MONEY!

435

REVERSE THIS FOR
UPGOING FRACTAL

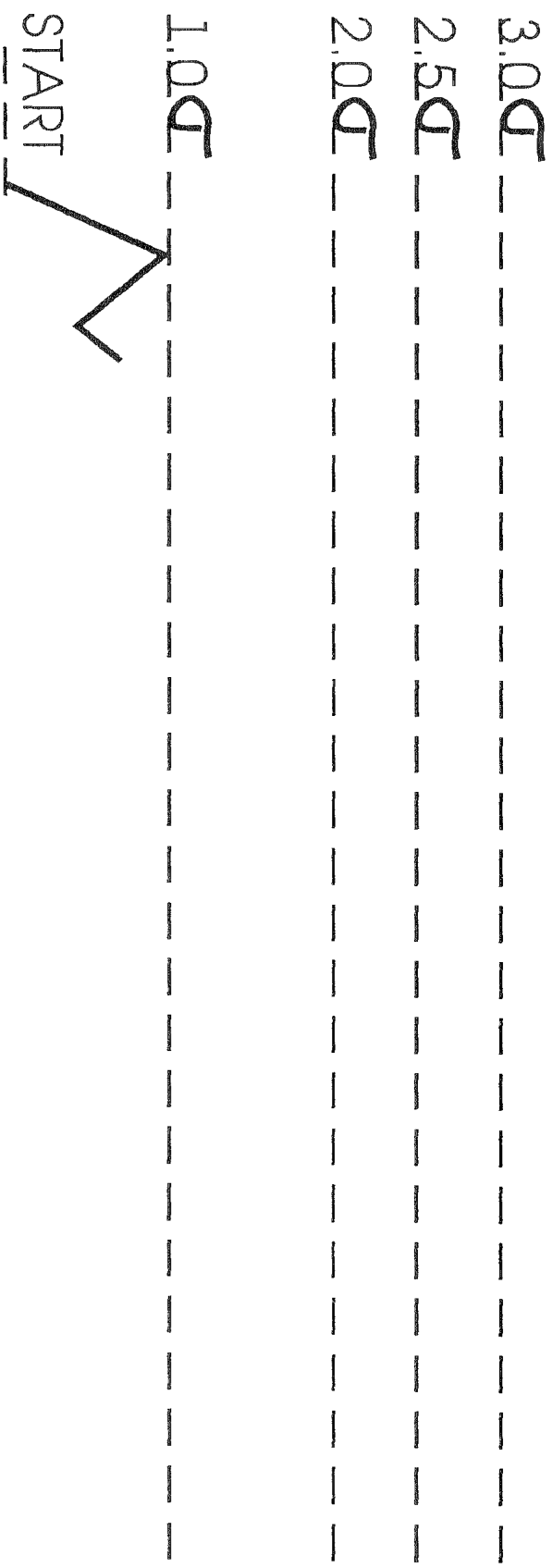
TAKING PROFITS FROM THE
HANNULA FRACTAL

430



PROJECTING IN ADVANCE

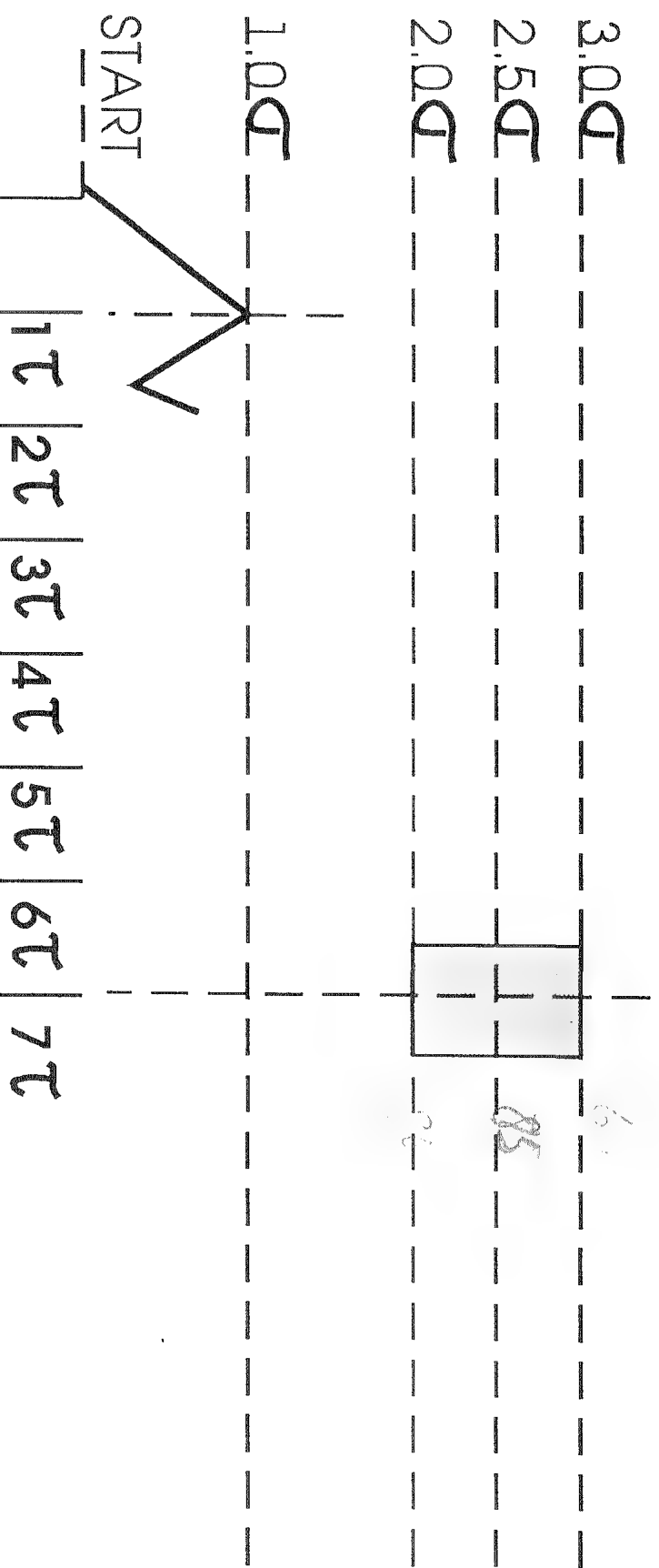
THE HANNULA SIGMA-TAU METHOD



1. FIND A THRUST AND PULLBACK
2. CALL HEIGHT OF THRUST σ (SIGMA)
3. PROJECT UP 2, 2.5, AND 3 SIGMA

PROJECTING IN ADVANCE

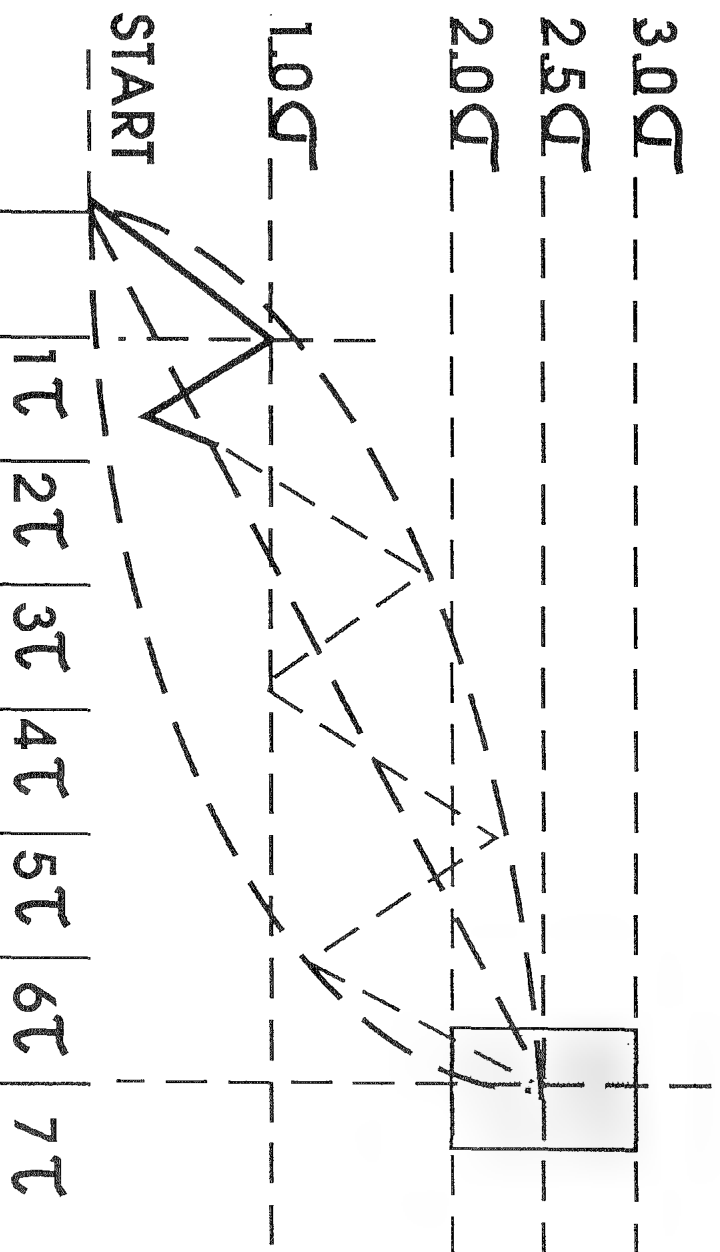
THE HANNULA SIGMA-TAU METHOD



4. ESTIMATE τ (TAU) AS 1/7TH OF THE FRACTAL TIME
(use risetime of thrust wave initially)
5. PROJECT 7 τ INTERVALS
6. MARK TARGET AT 7 τ , 2.5 G

PROJECTING IN ADVANCE

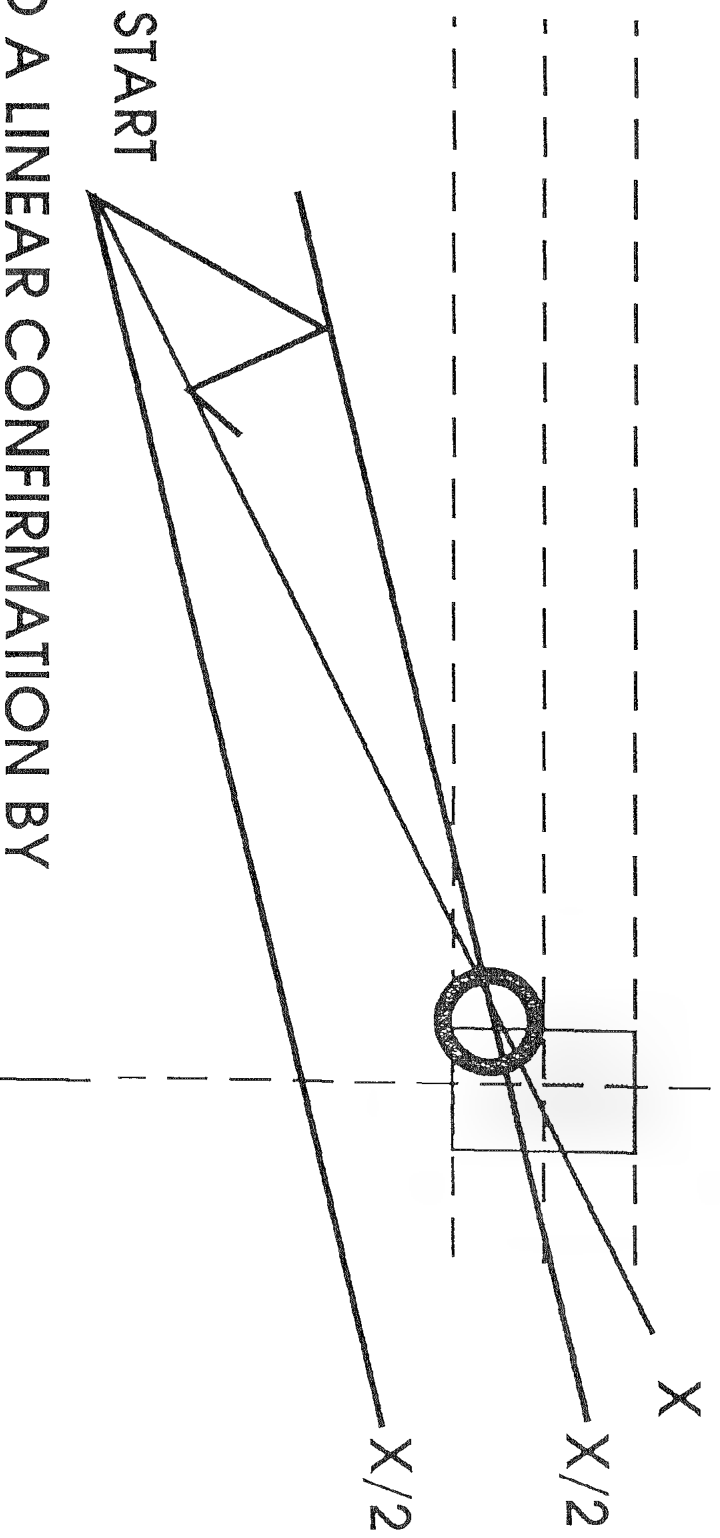
THE HANNULA SIGMA-TAU METHOD



7. DRAW LINE OF CENTRAL TENDENCY
8. DRAW LIMIT CYCLES
9. SKETCH THE 7 MOVES

PROJECTING IN ADVANCE

THE HANNULA SIGMA-TAU METHOD



10. DRAW SUPPORT LINE X FROM START THROUGH MOVE 2
11. DRAW RESISTANCE LINE WITH HALF THE SLOPE OF X FROM THE TOP OF MOVE 1
12. CROSSING POINT IS USUALLY NEAR TARGET

422.0

Hans Hannu's Market Astro Physics #123 Trader

421.0

420.0

419.0

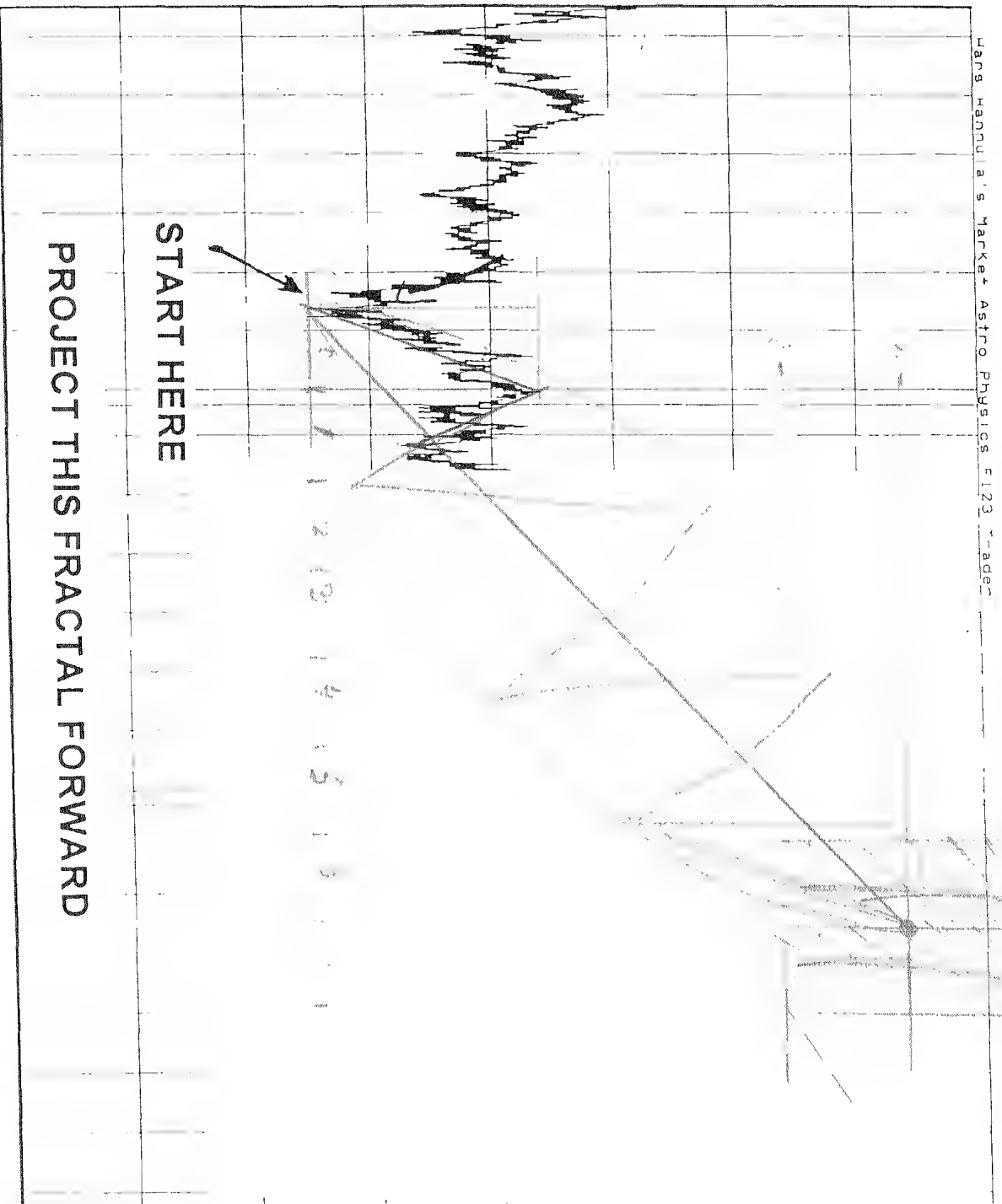
418.0

417.0

416.0

415.0

414.0



10 11 12 13 14 15 16 10 11 12 13 14 15 16
10/27

10/28

10/29

422.0

Hans Hergula's Market Astro Physics, FL23, Trader

421.0

420.0

419.0

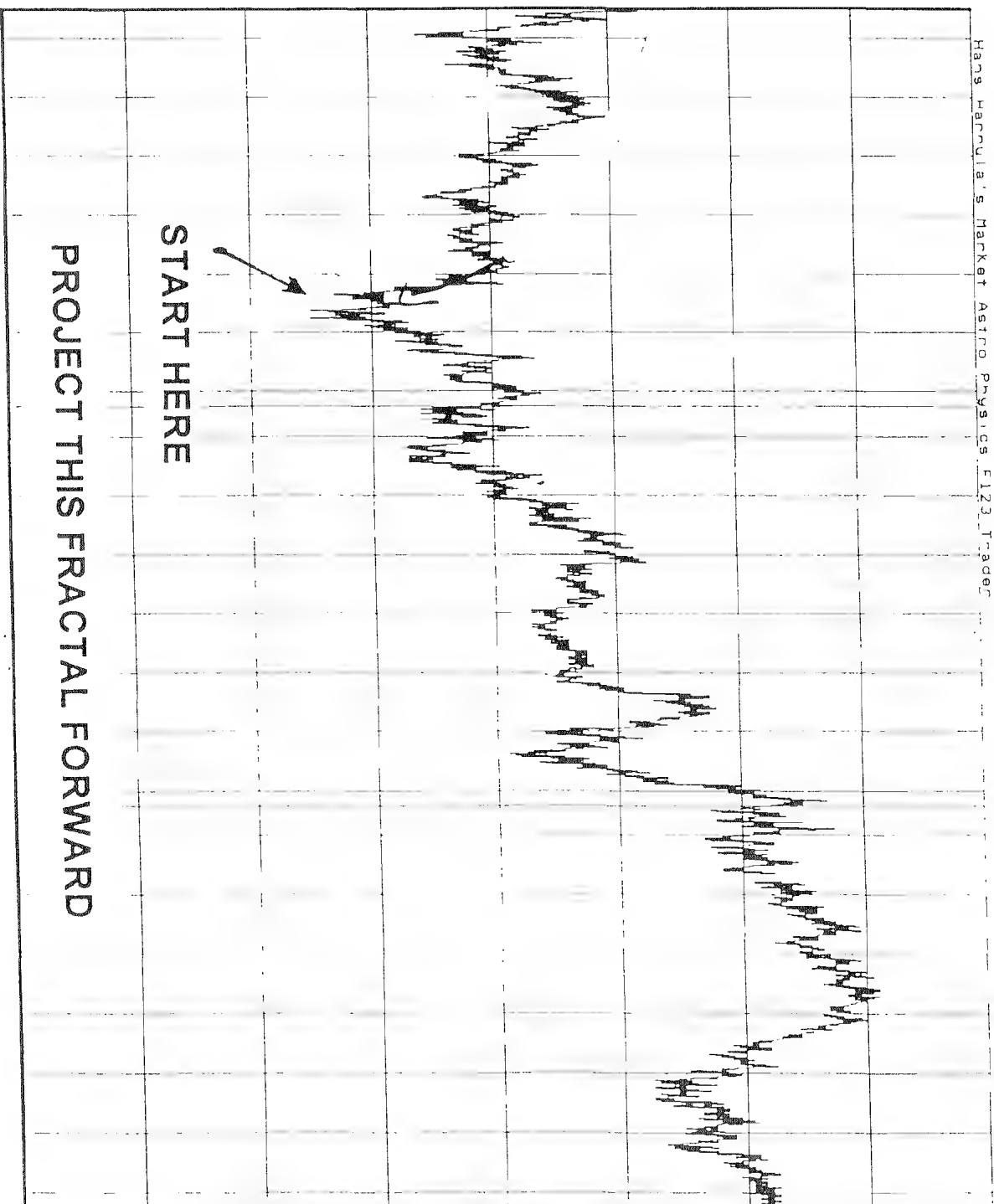
418.0

417.0

416.0

415.0

414.0

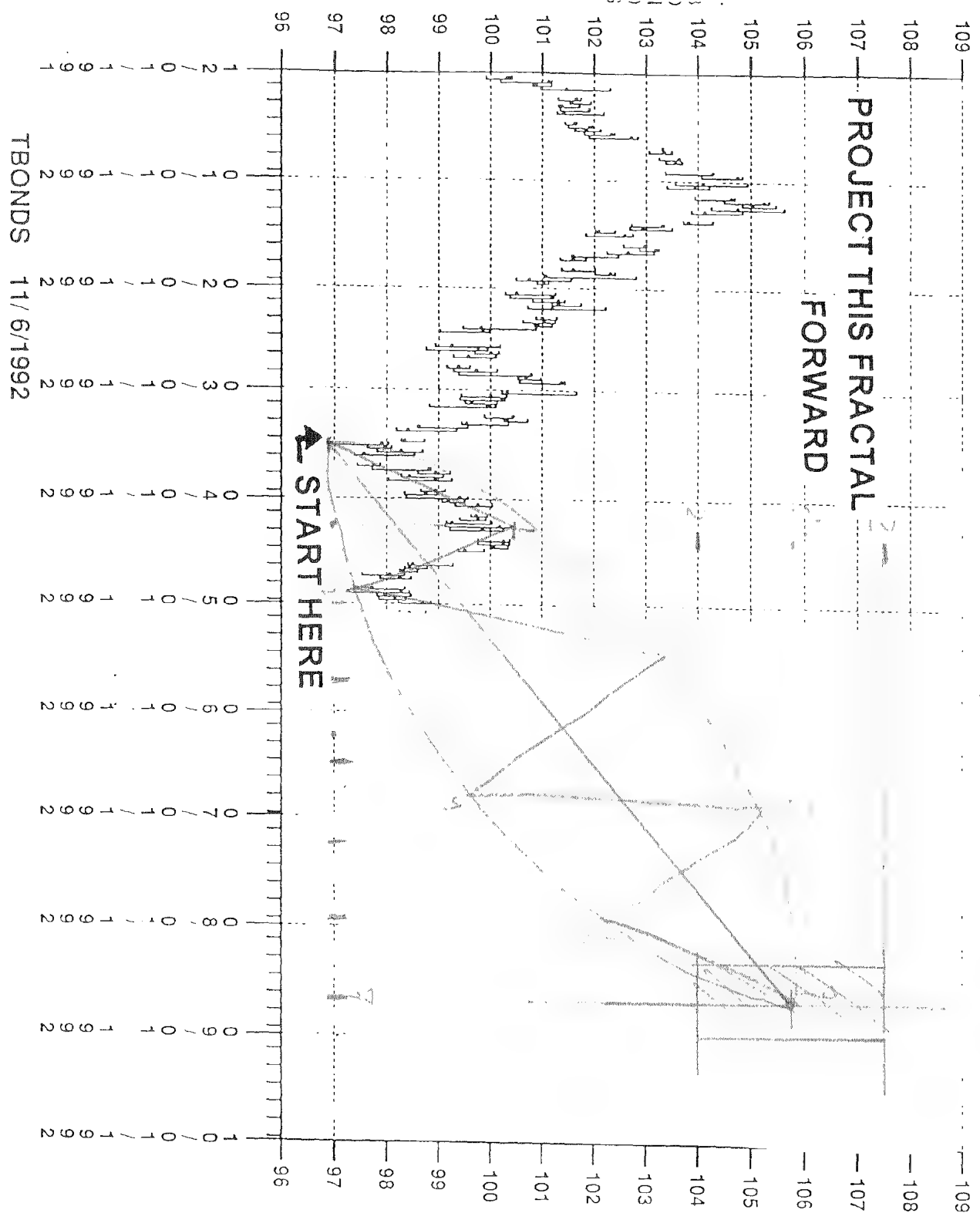


10
11
12
13
14
15
16
10/27

10/28

10
11
12
13
14
15
16
10/29

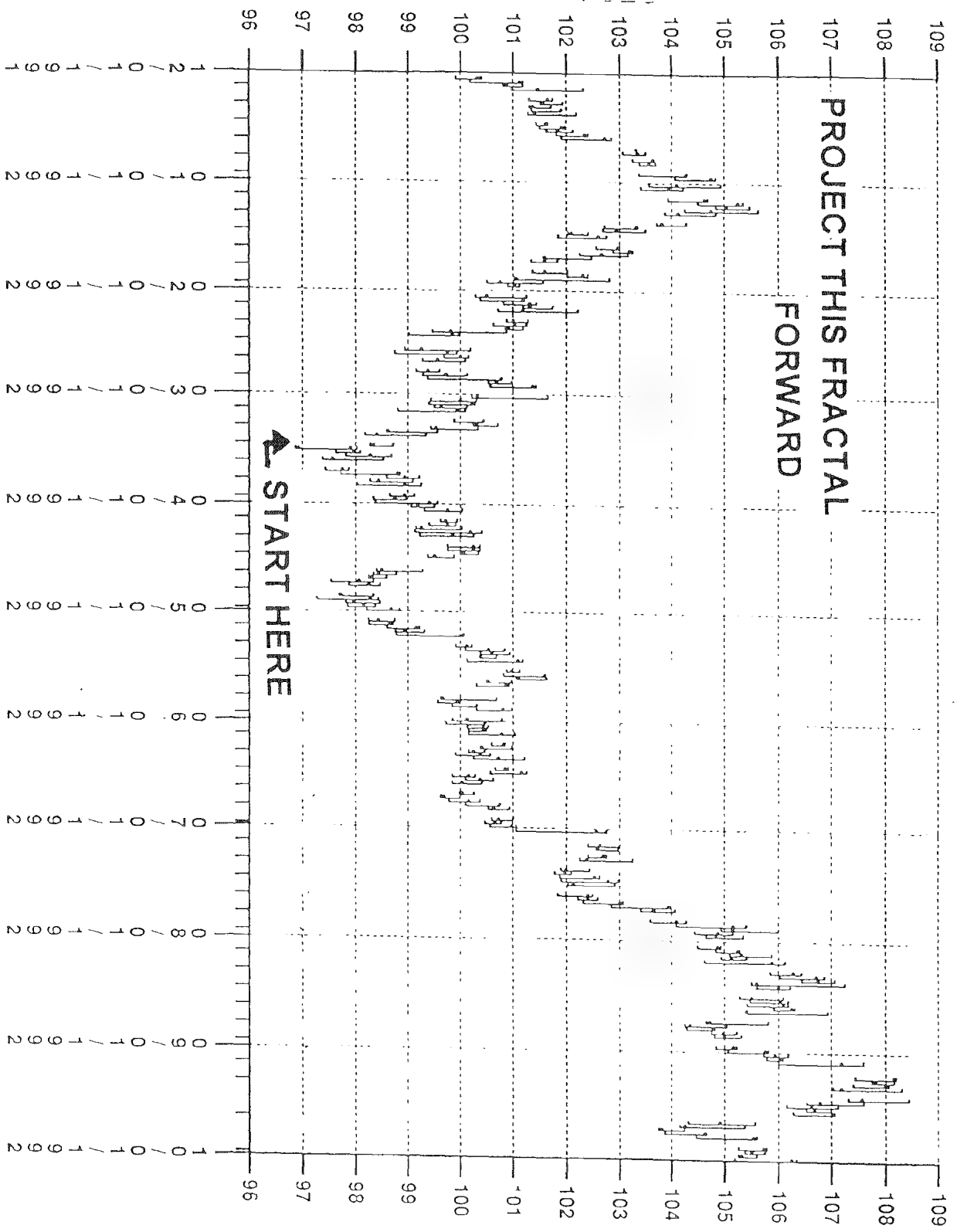
PROJECT THIS FRACTAL FORWARD



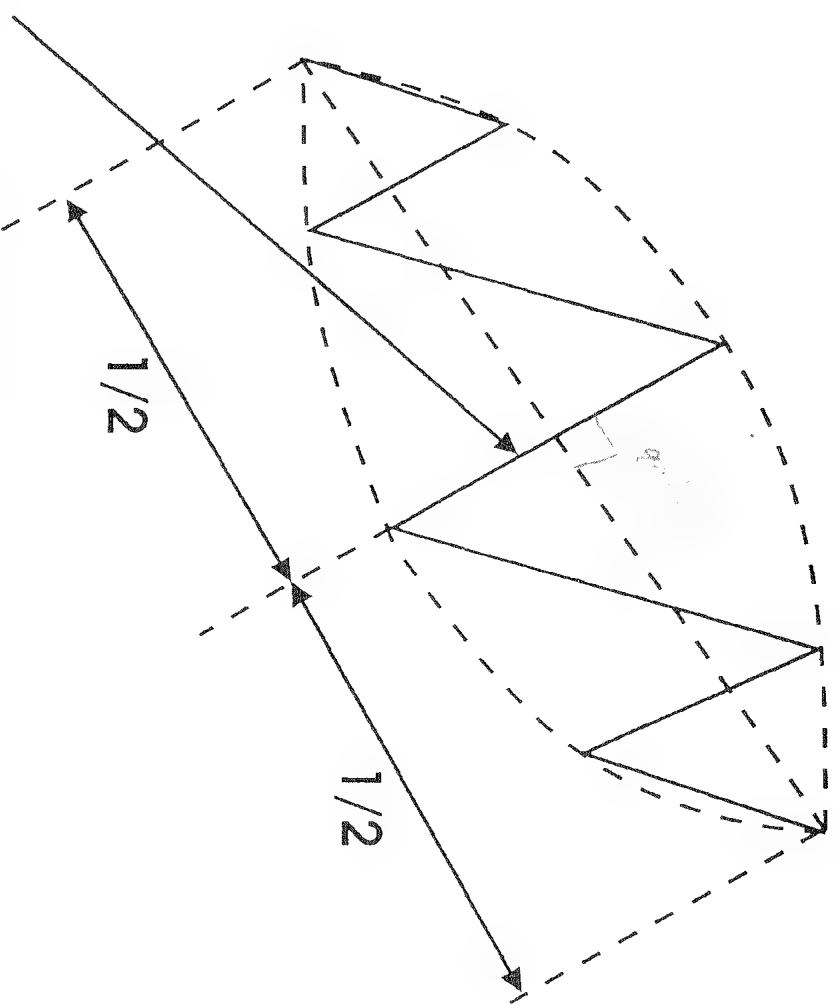
PROJECT THIS FRACTAL FORWARD

START HERE

TBONDS 11/6/1992

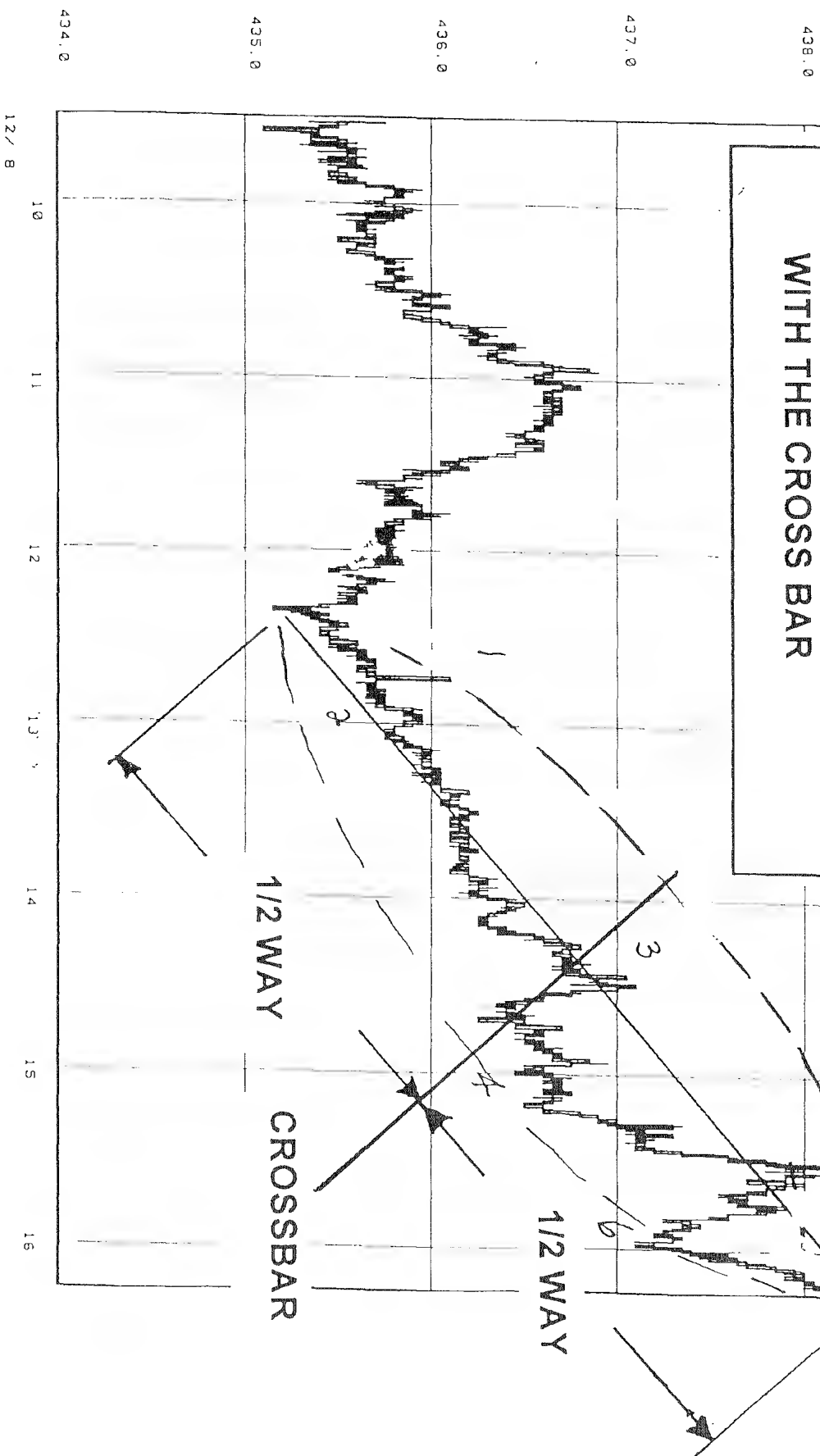


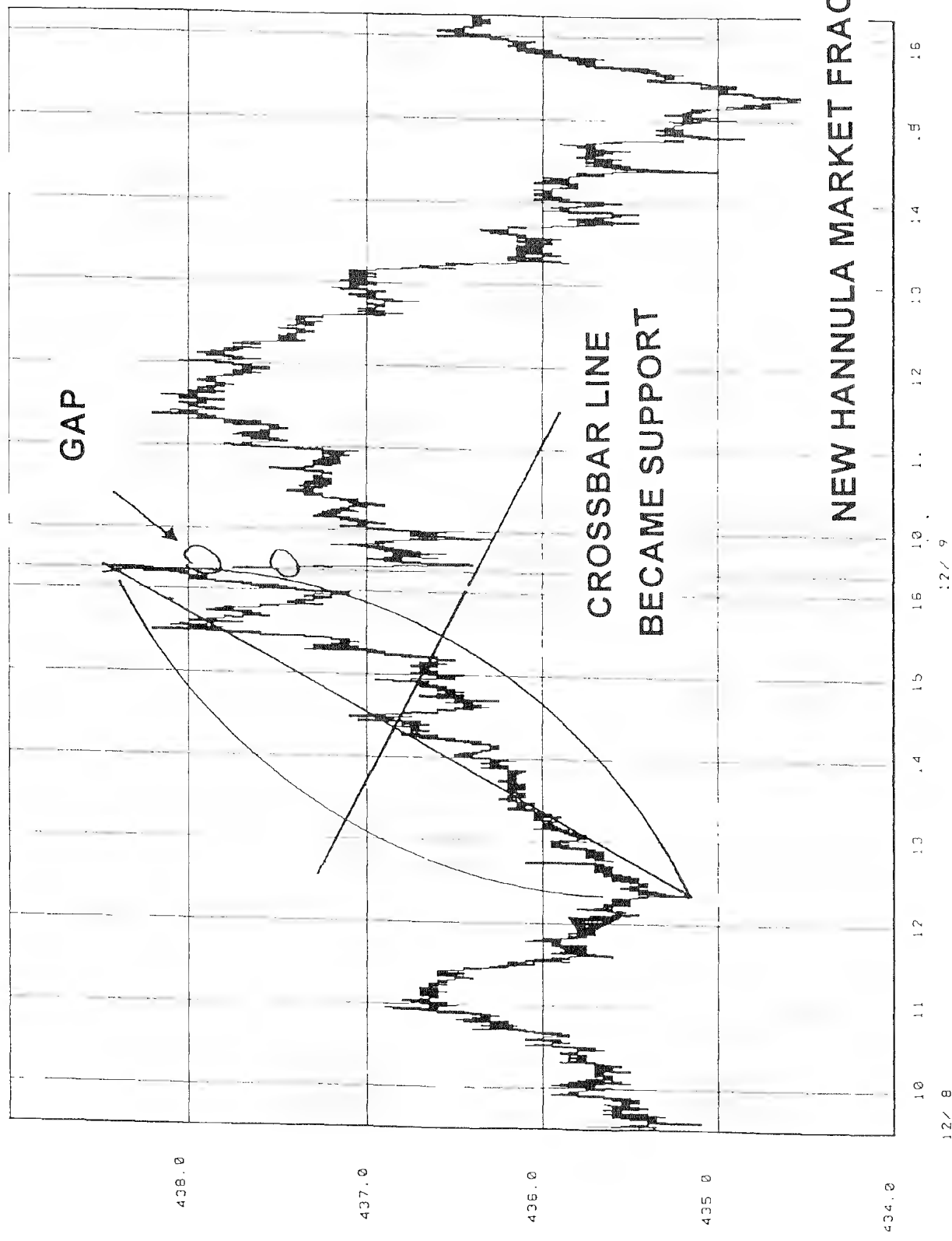
THE CROSSBAR



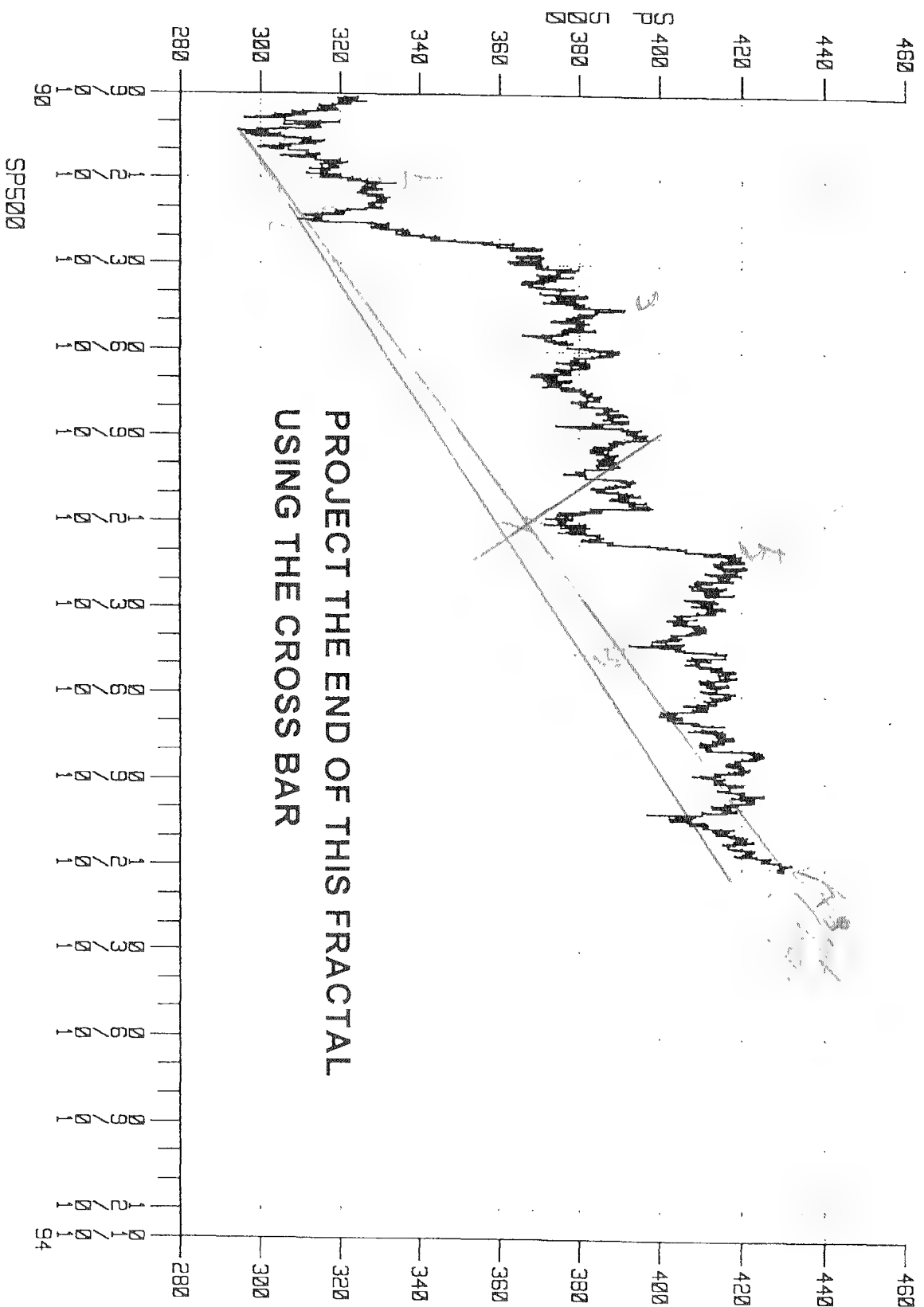
THE CROSSBAR IS THE FOURTH LEG
OF THE HANNULA FRACIAL. IT USUALLY MARKS
THE HALF WAY POINT IN THE MOVE. IT CAN THEREFORE
BE USED TO PROJECT THE END OF THE FRACIAL.

PROJECTING END OF FRACTAL WITH THE CROSS BAR





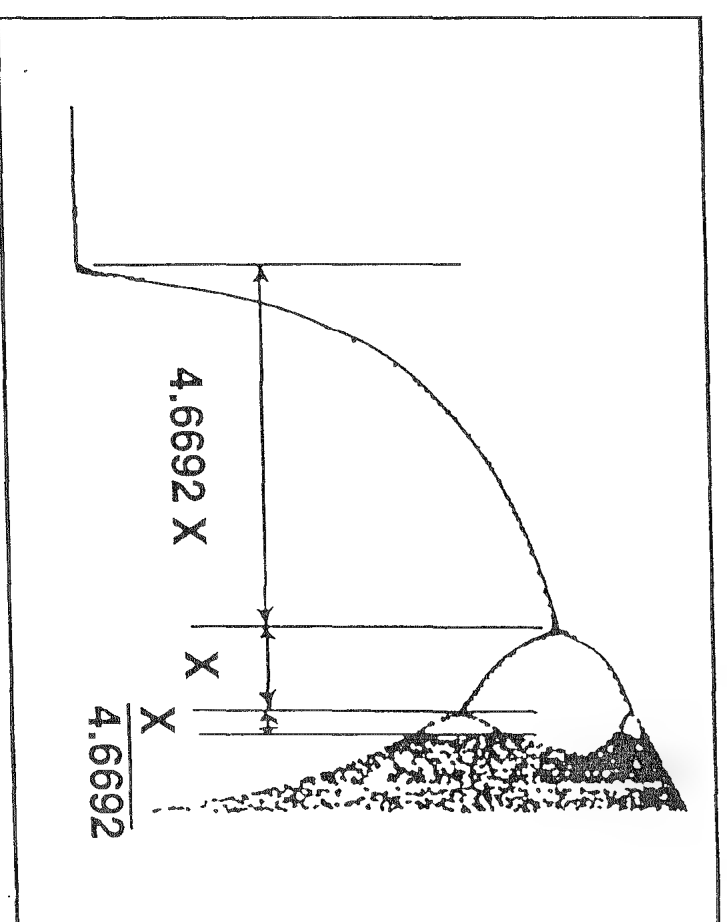
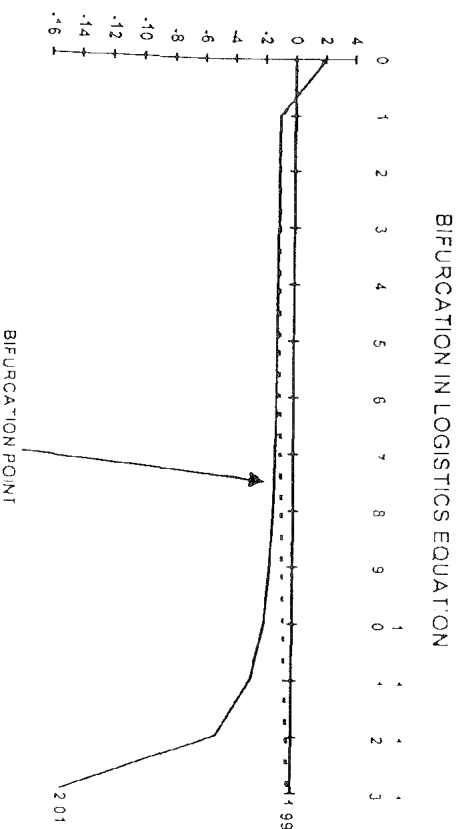
NEW HANNULA MARKET FRACTAL



BIFURCATION AND THE FEIGENBAUM CONSTANT

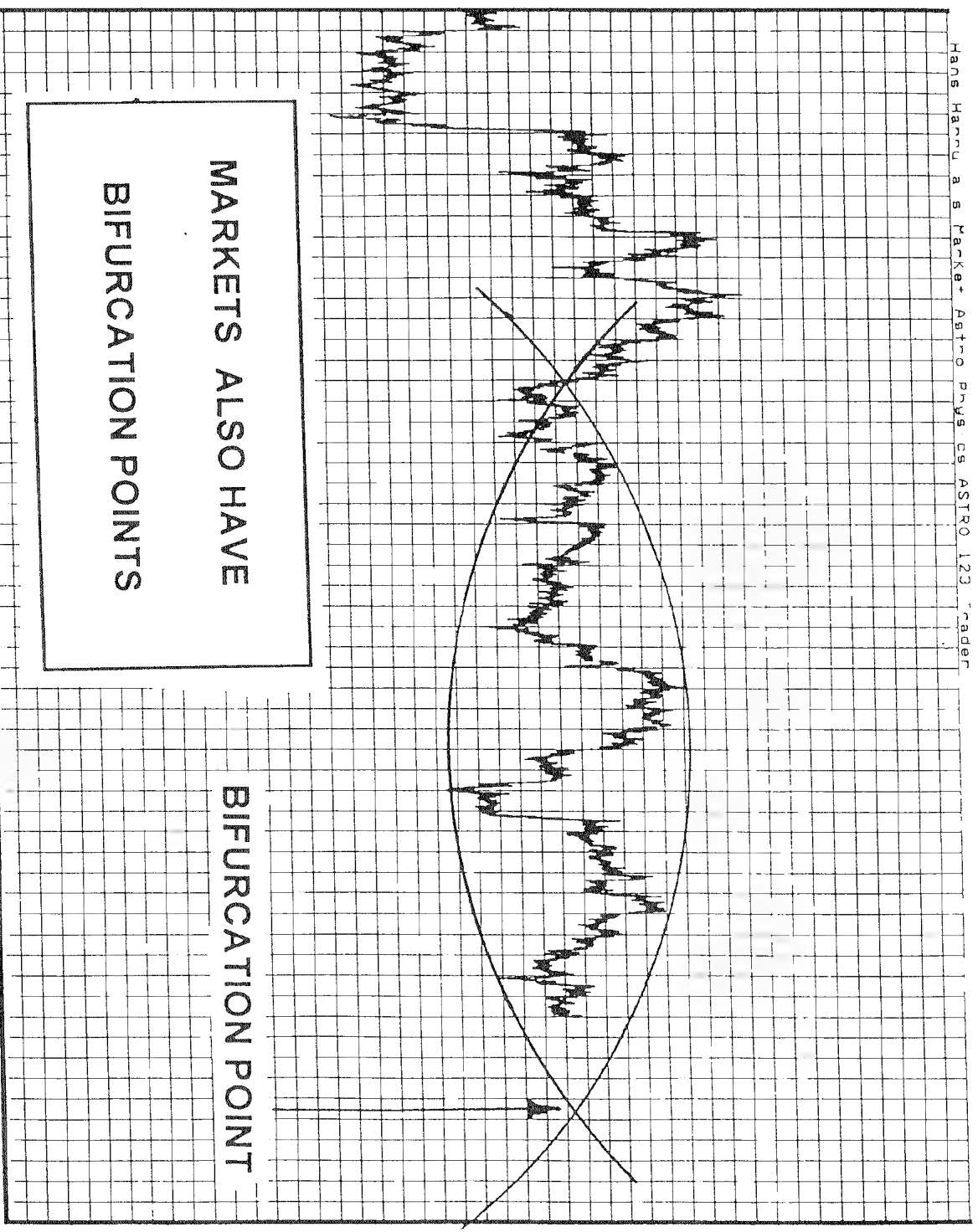
1. BIFURCATION MEANS CHOOSING BETWEEN TWO PATHS
2. FEIGENBAUM SHOWED AND LANFORD PROVED THAT BIFURCATION OCCURS AT POINTS RELATED BY

4.669201609 WHICH IS A UNIVERSAL CONSTANT LIKE π



466
465
464
463
462
461
460
459
458
457
456
455
454
453
452
451
450
449
448
447
446
445
444
443
442
441
440
439
438
437
436
435
434
433
432
431
430
429
428
427
426
425
424
423
422
421
420

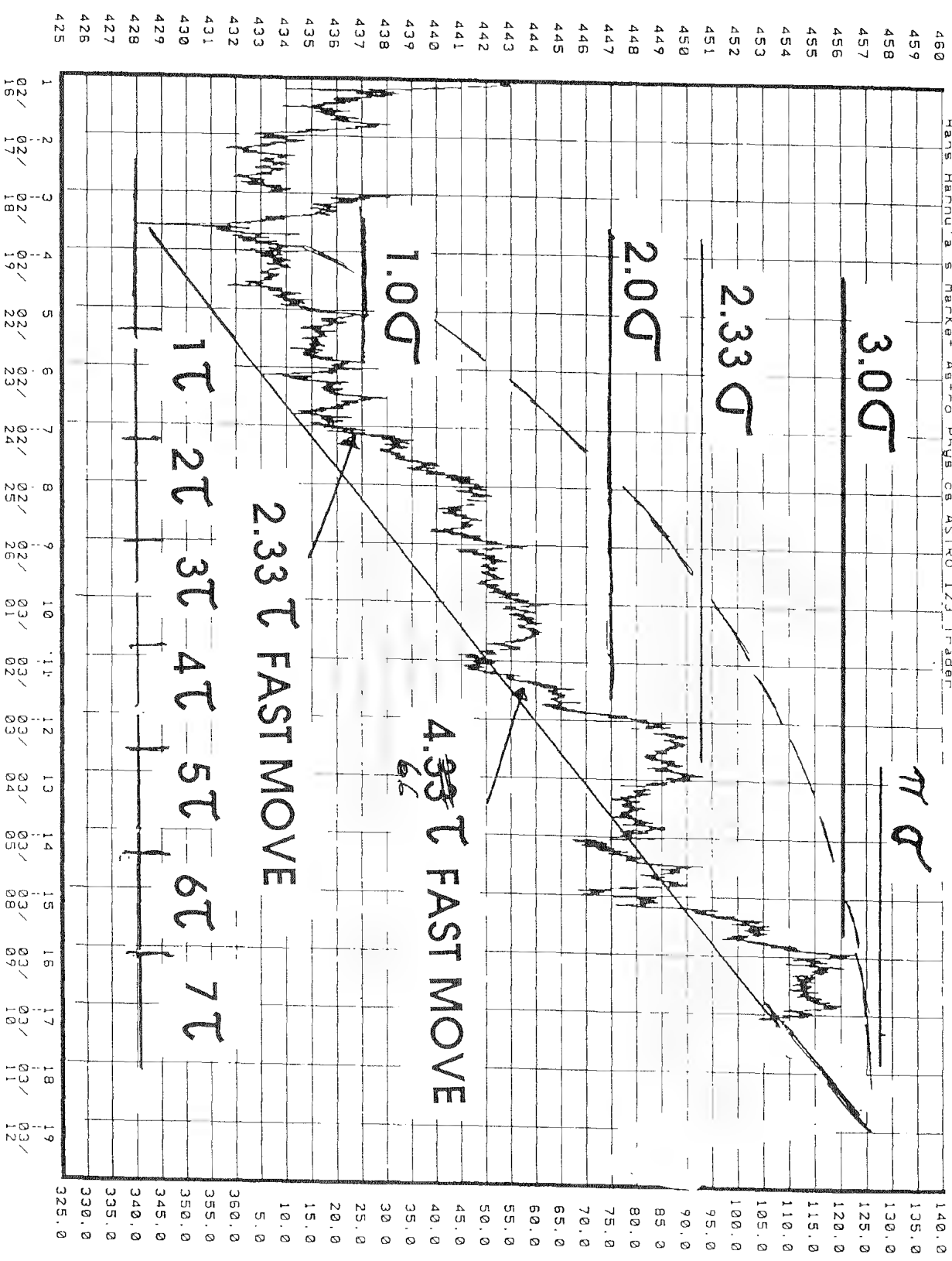
Hans Haruu a s Marke+ Astro Phys cs ASTRO 123 reader



1
05/
12
5
05/
18
9
05/
24
13
05/
28
17
06/
04
21
06/
10
25
06/
16
29
05/
22
33
06/
28
37
07/
02
41
07/
09
45
07/
15
49
07/
21
53
07/
27
57
08/
02

S&P 500 NEAR

Hans Harms's Market Astro Phys cs ASTRO 123 Trader



S&P 500 NEAR

DO TODAY:

USING THE STOP AND REVERSE (SAR)

1. RECOGNIZES WIDE TAILS OF PARETIAN STATISTICS
2. WILL ALWAYS HAVE YOU IN THE BIG MOVES
3. SAVES ALL REGRETS

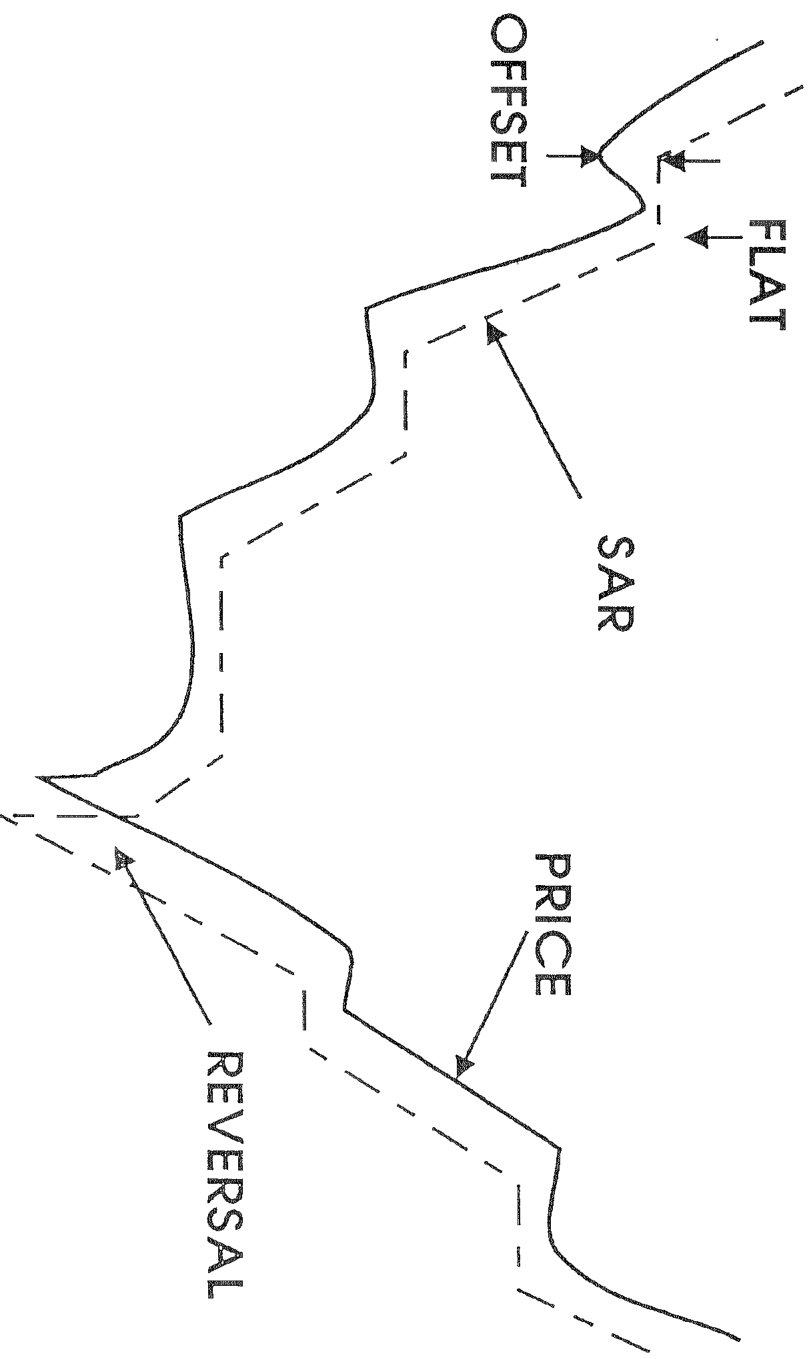
TO COMPUTE:

1. USE C LOSING PRICES (5 minute for daytrading)
2. TO BEGIN:
IF TREND IS DOWN
$$\text{SAR} = \text{LAST CLOSE} + \text{OFFSET} \quad (\text{OFFSET} = .8 \text{ FOR S\&P DAYTRADE})$$

IF UP
$$\text{SAR} = \text{LAST CLOSE} - \text{OFFSET}$$
3. FOLLOWING STEPS:
IF DOWN,
AND LAST CLOSE IS MORE THAN OFFSET BELOW THE SAR,
$$\text{NEW SAR} = \text{LAST CLOSE} + \text{OFFSET}$$

IF UP,
AND MOST LAST CLOSE IS HIGHER THAN OFFSET ABOVE THE SAR,
$$\text{NEW SAR} = \text{LAST CLOSE} - \text{OFFSET}$$
4. IF LAST CLOSE CROSSES SAR, REVERSE THE TRADE AND
START OVER AT STEP 3.

THE STOP AND REVERSE LINE



1. EASILY ADDED TO MANY ONLINE SOFTWARE SYSTEMS
2. CHOICE OF OFFSET DETERMINES PROFIT
 - CHOPS WHEN RANGE IS LESS THAN 2 X OFFSET
 - IF CHOP, IN TRADING RANGE, USE VOL. B. O.

© 1993 Dr. Hans Hannula
May not be reproduced.

Sources of Market Chaos

WHAT IS MARKET ASTROPHYSICS?

Market Astrophysics is the study of the Solar Energy System and its effect on markets.

WHAT ARE THE PARTS OF THE SYSTEM?

- sun
- 9 planets
- moon
- solar wind
- electromagnetic field
- humans
- markets

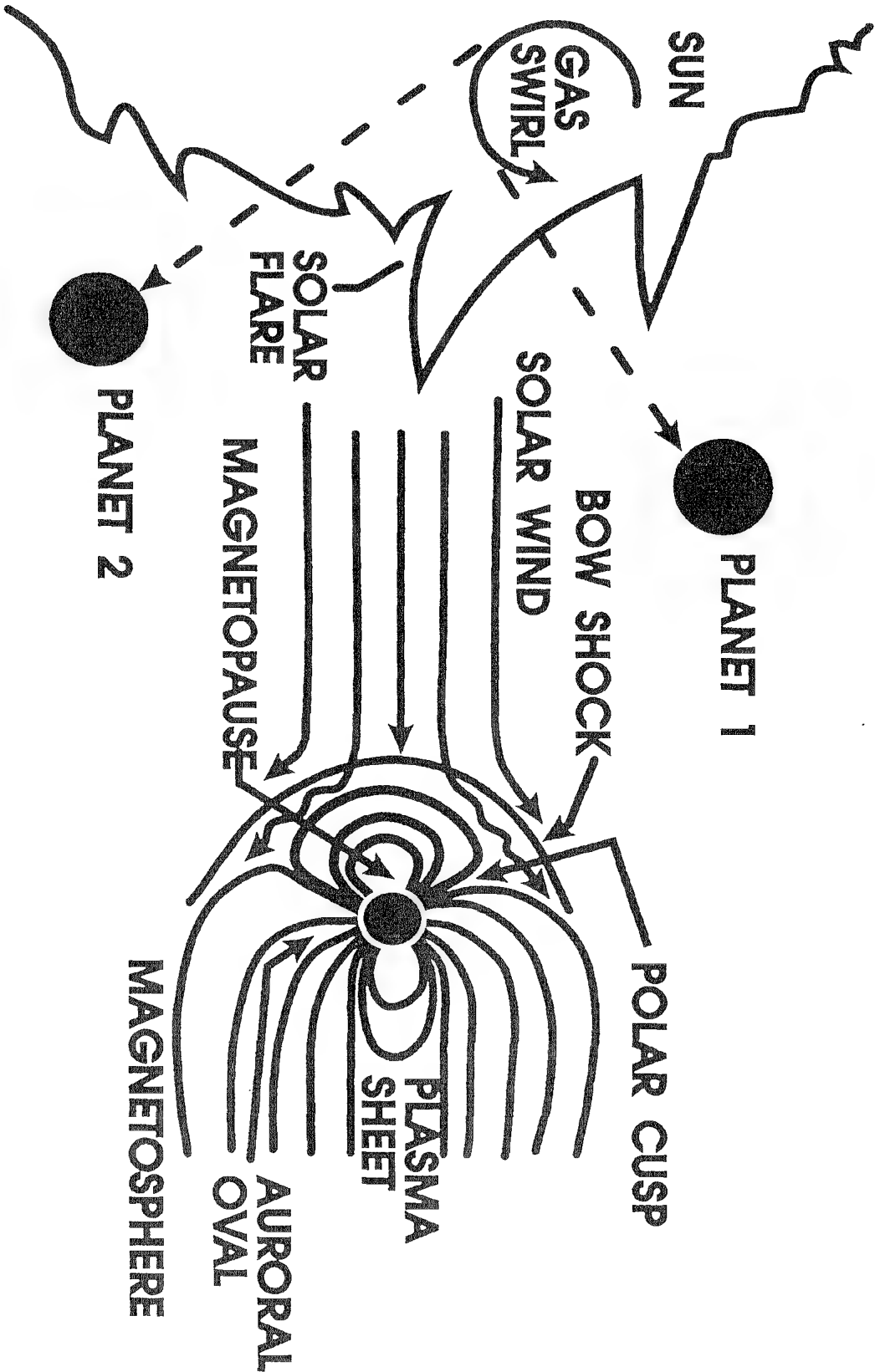


Figure 1. SOLAR STRRING FORCE

MARKET ASTROPHYSICS METHODOLOGY

- 1. DEVELOPE PHYSICAL THEORY**
- 2. DEVELOP MATHEMATICAL MODEL**
- 3. COMPUTE TIME SERIES**
- 4. TEST CORRELATION**
- 5. IF GOOD, ADD TO TOOLKIT**
- 6. TEST BY USE IN MARKET**

SOURCES OF MARKET CHAOS

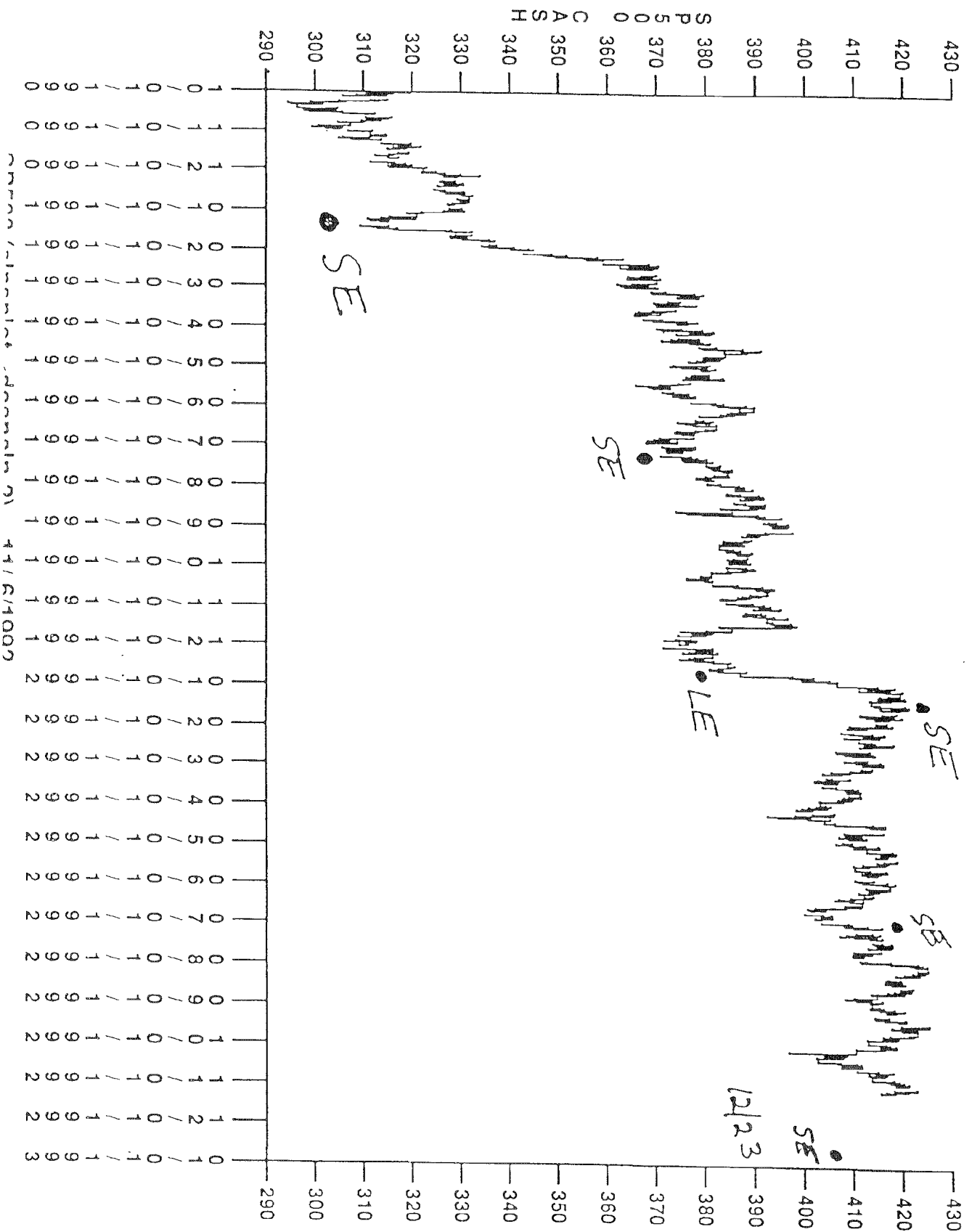
Anything that interrupts the energy flow

- solar and lunar eclipses
- planetary eclipses
- lunar chaos events
- market hours

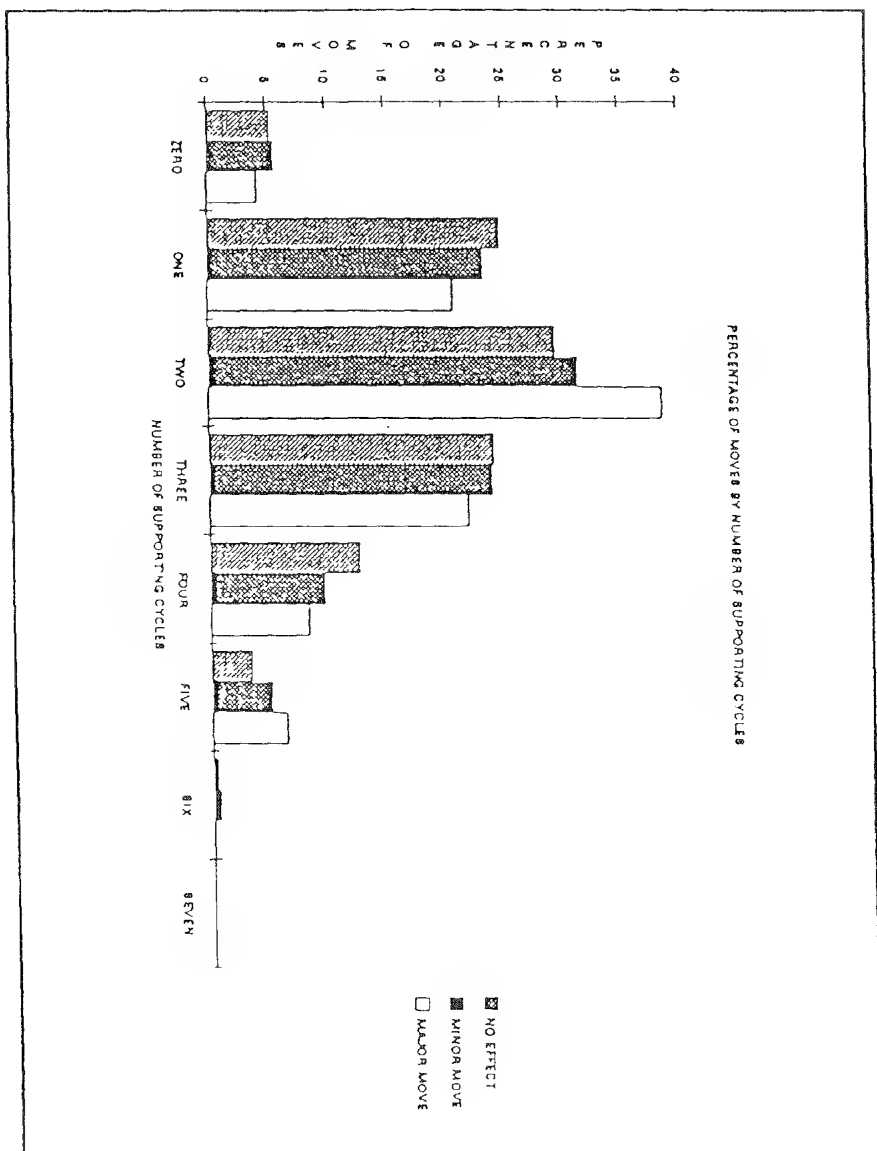
Harmonic Energy Addition

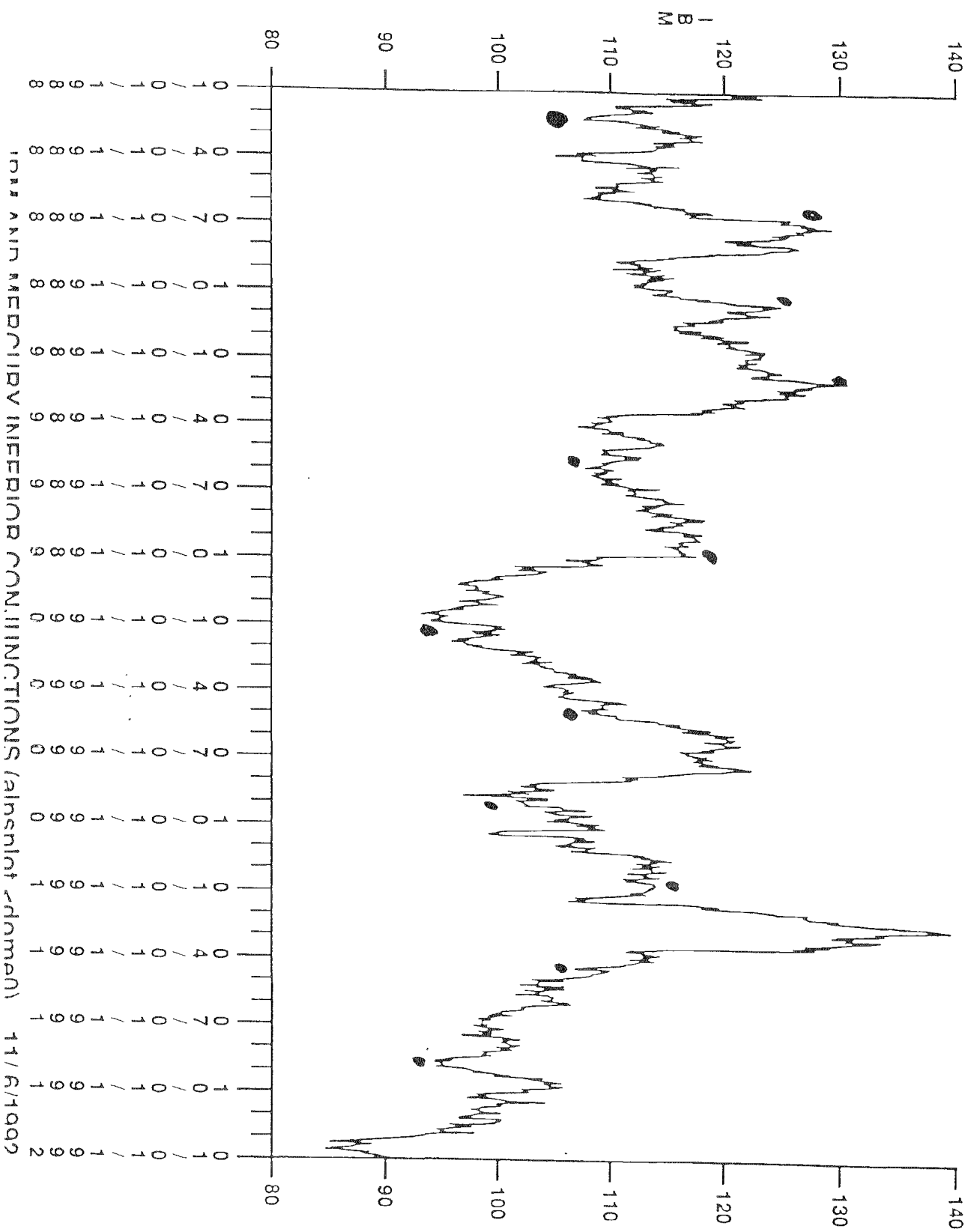
- addition of linear and nonlinear cycles
- jump resonance events

Movement of the Center of Solar System Mass



one chart from
 "Trading the Eclipses"



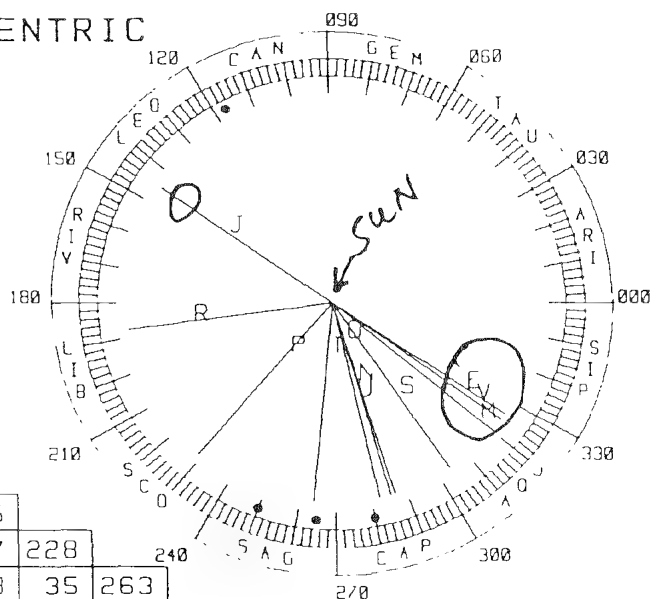


MARKET ASTROPHYSICS EPHEMERIS

HELIOCENTRIC

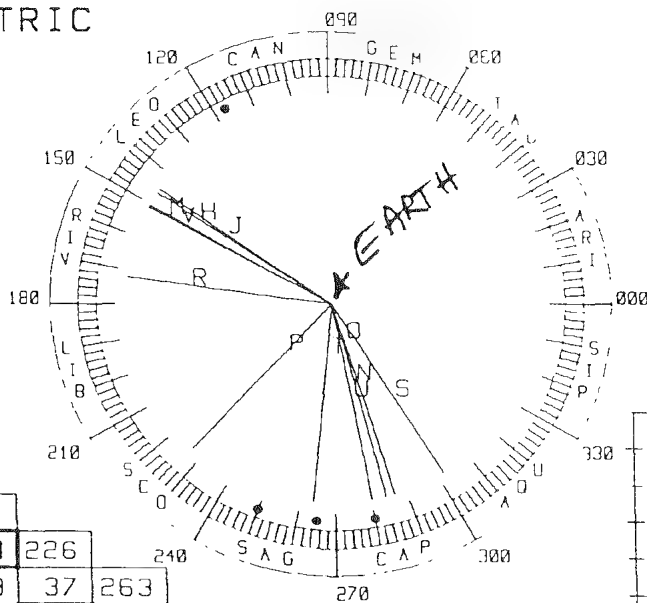
8 19 1991 17:00 UT

2448488.208 JED

[illegible]

GEOCENTRIC

M	150																		
V	359	151																	
H	4	5	146																
R	338	339	334	171															
J	5	6	1	27	144														
S	200	209	204	230	203	301													
U	230	231	226	252	225	21	280												
N	226	227	222	248	221	17	356	284											
P	283	284	279	305	278	75	53	58	226										
T	114	113	110	92	119	322	344	339	37	263									
O	223	224	219	245	218	345	7	3	60	337	286								
A	260	261	256	282	255	308	330	326	23	14	37	250							
B	245	246	241	267	240	323	345	341	38	359	22	345	265						
C	230	231	226	252	225	338	360	356	53	344	7	330	345	280					
D	33	34	29	55	28	175	197	193	250	147	170	133	148	163	117				
	M	V	H	R	J	S	U	N	P	T	Q	A	B	C	D				



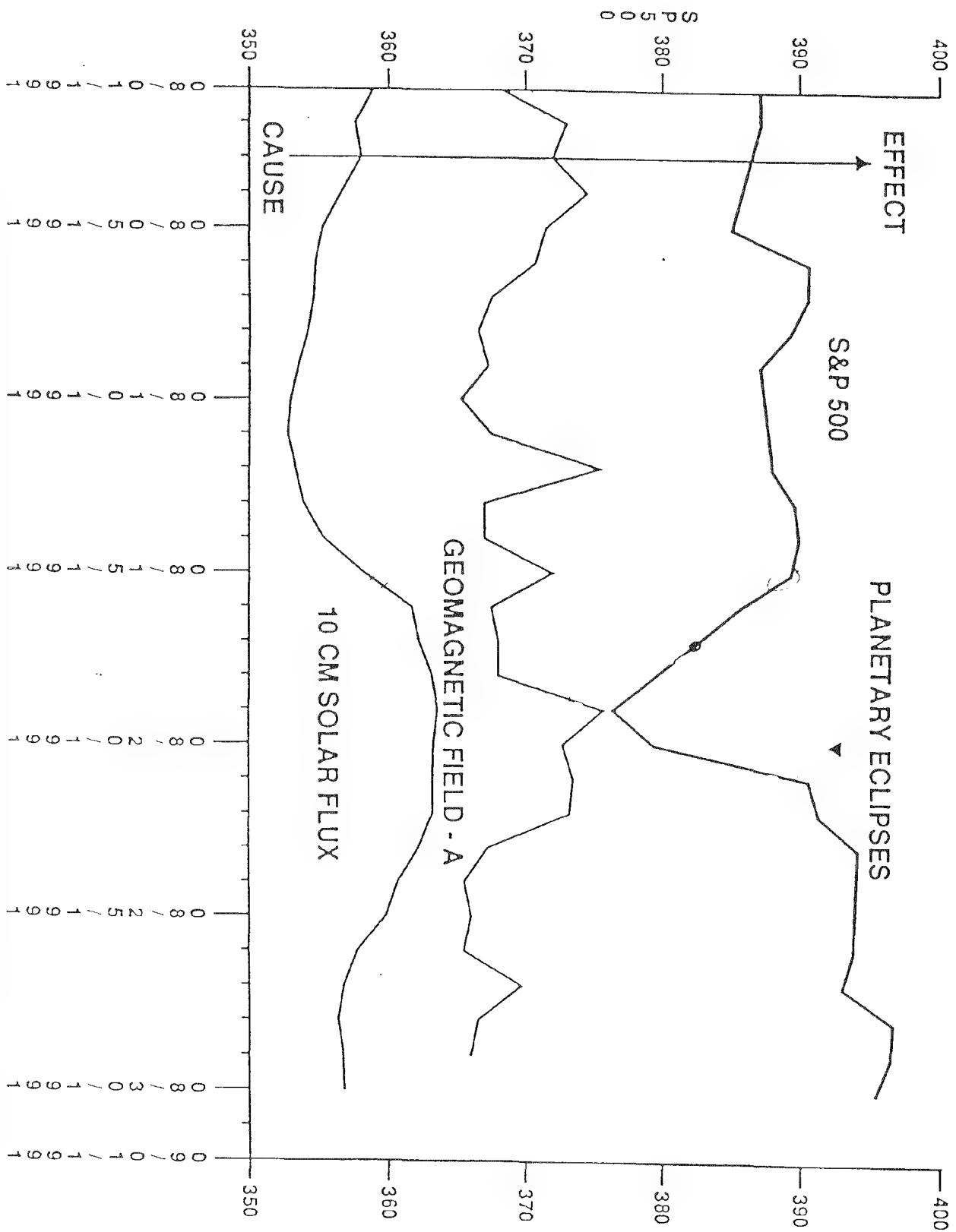


FIGURE 4 ASTROPHYSICS OF THE DOUBLE PLANETARY ECLIPSE 10/22/1991

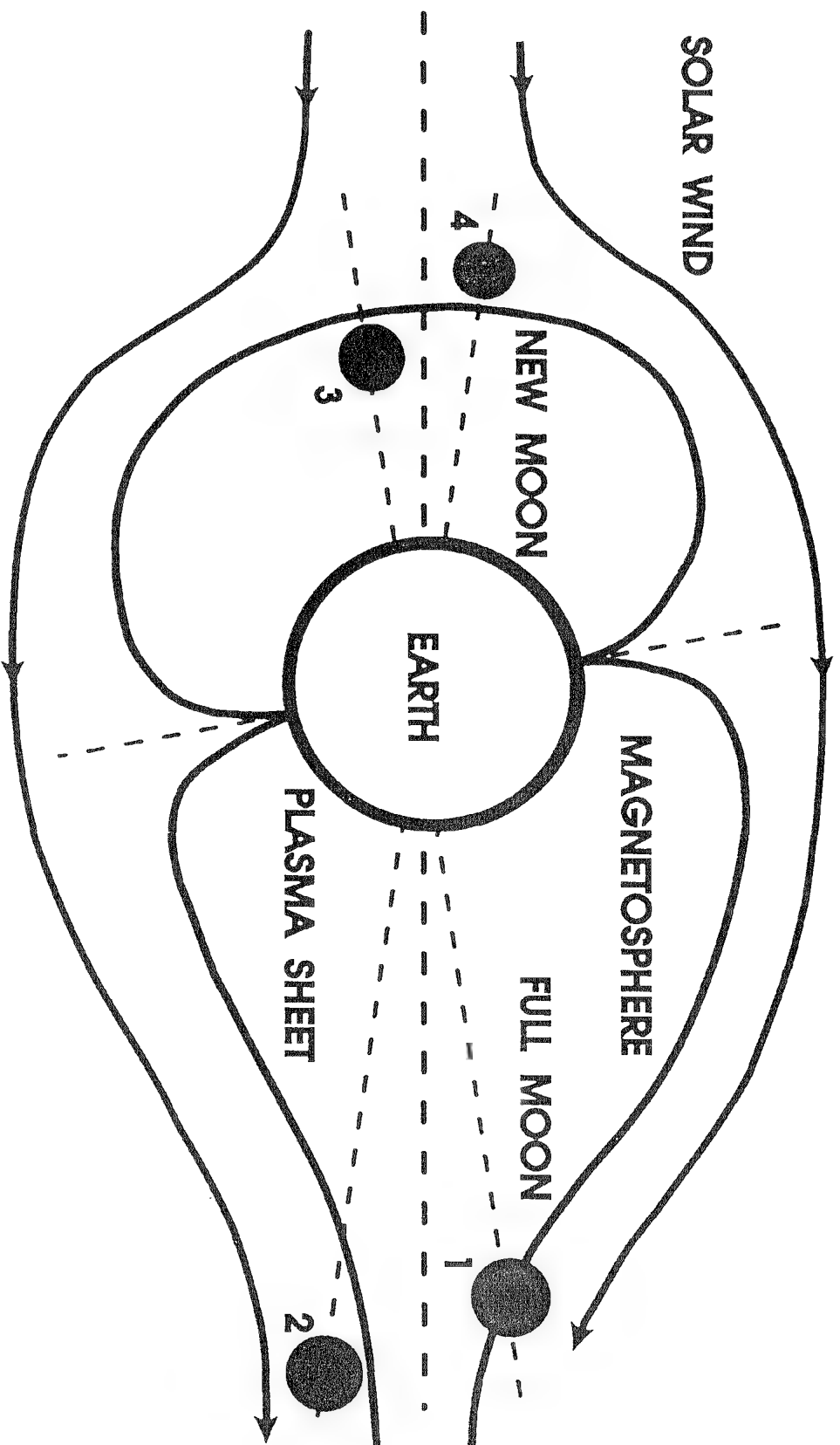


Figure 2. LUNAR CHAOTIC BOUNDARIES

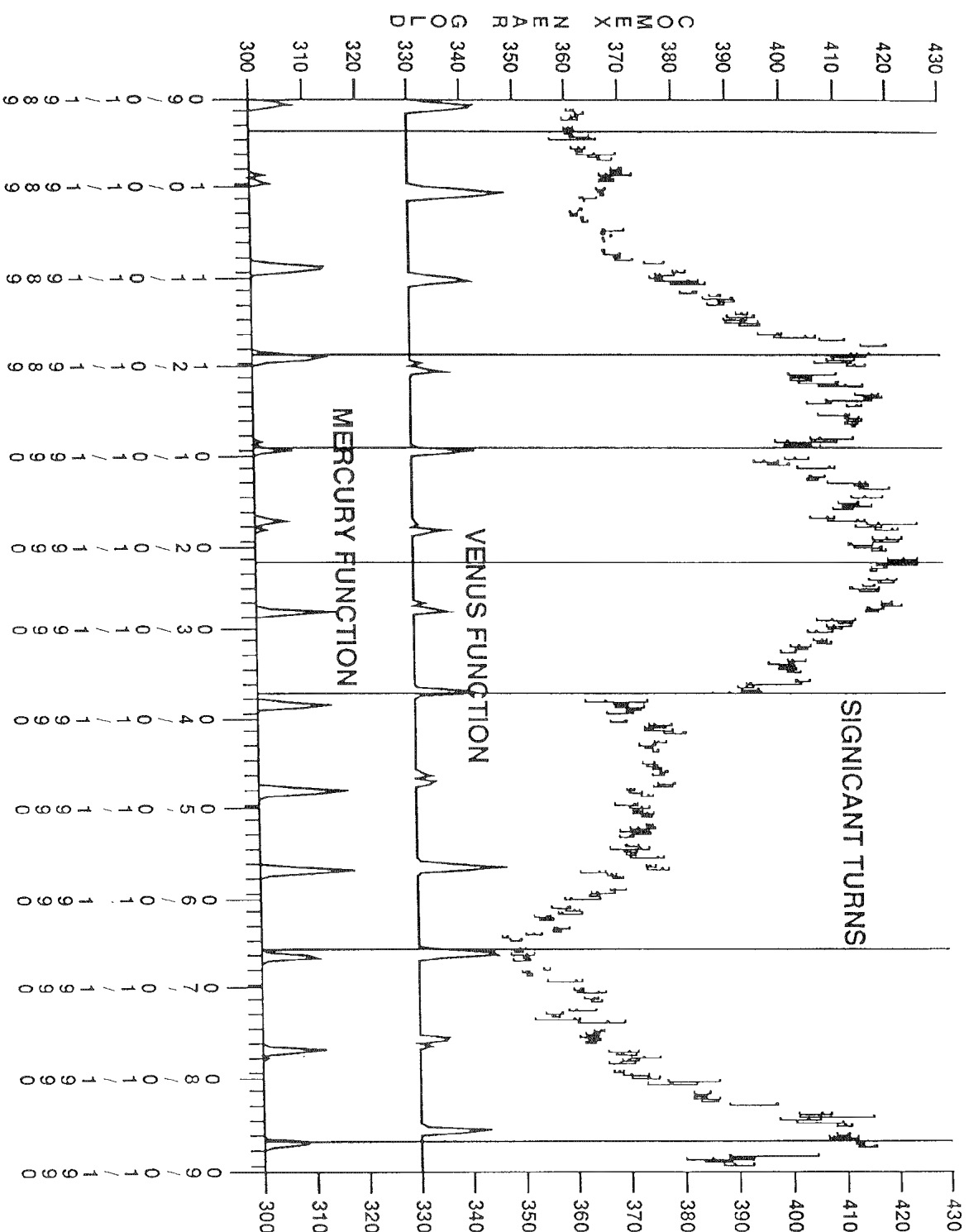


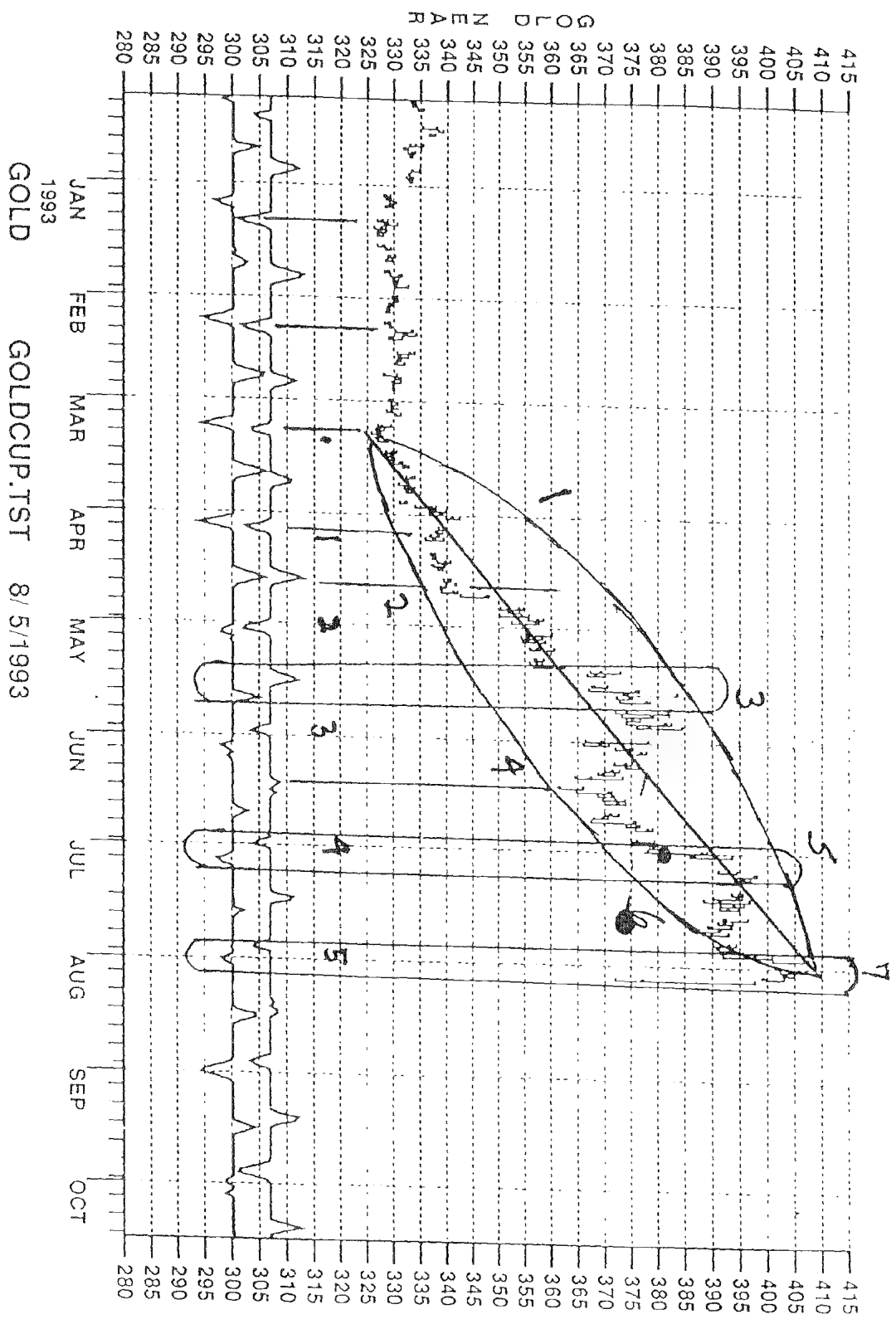
Figure 5. GOLD AND THE TWO LUNAR CHAOS FUNCTIONS

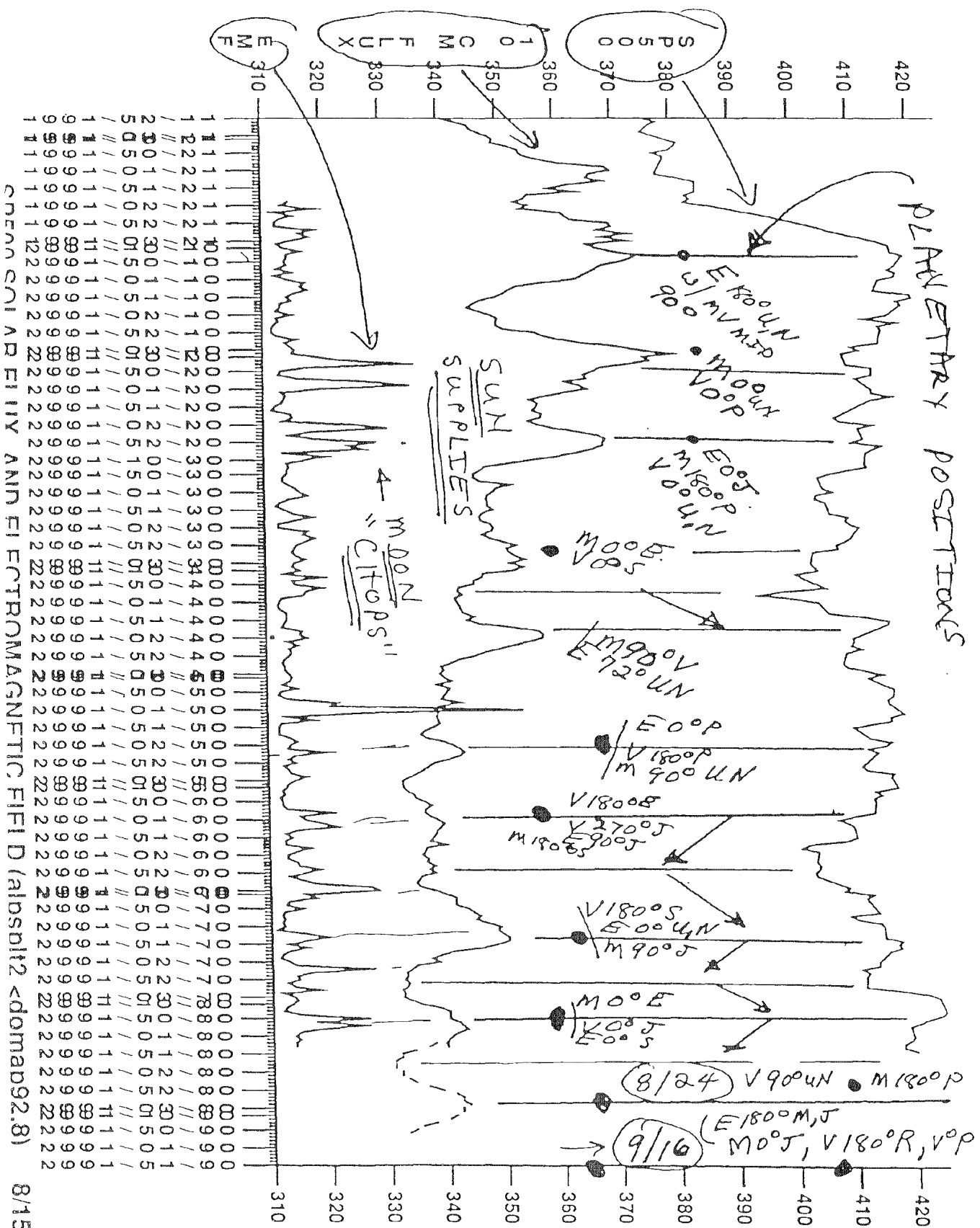
	NUMBER OF CHAOS EVENTS	NUMBER TURNS HITTING WINDOWS	PROBABILITY OF BEING RANDOM	ODDS AGAINST BEING RANDOM
VENUS	121	41	.00138	724:1
MERCURY	121	40	.00254	393:1
BOTH	88	31	.00350	285:1

NOTE: NUMBER OF TURNS IN GOLD = 85

WINDOW = 10 DAYS, INTERVAL = 3652 DAYS

Table 1. Gold Chaos Statistics





Conclusion

SOURCES OF MORE INFORMATION

Books

1. Chaos, The Making of a New Science, Glieck
2. Chaos and Order in the Capital Markets, Edgar Peters
3. The Fractal Geometry of Nature, Mandelbrot
4. A First Course in Chaotic Dynamical Systems, Devaney

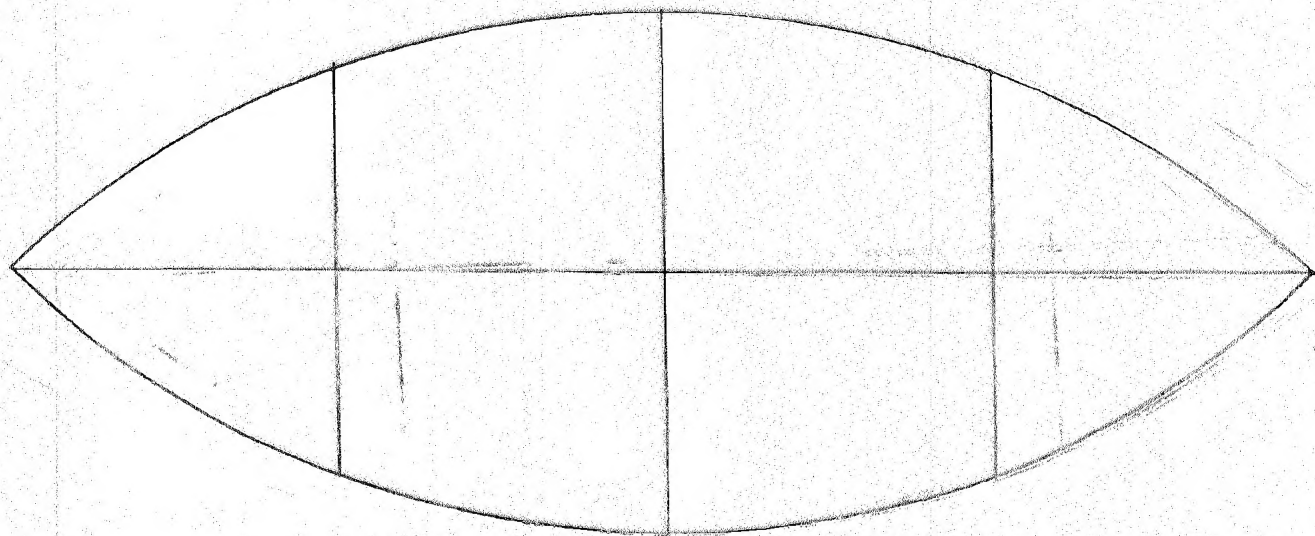
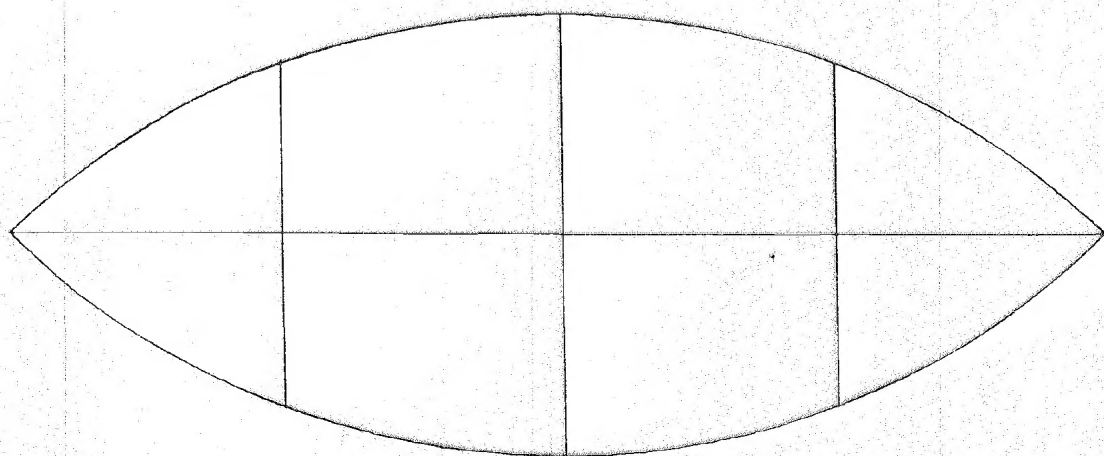
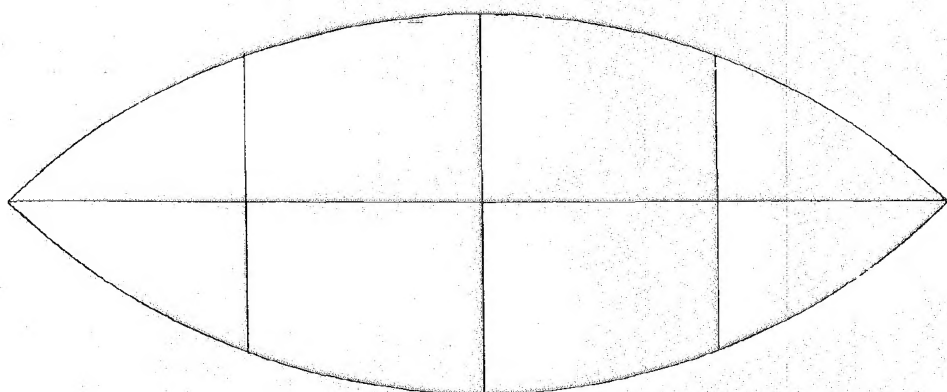
Articles

Hannula, Landscheidt

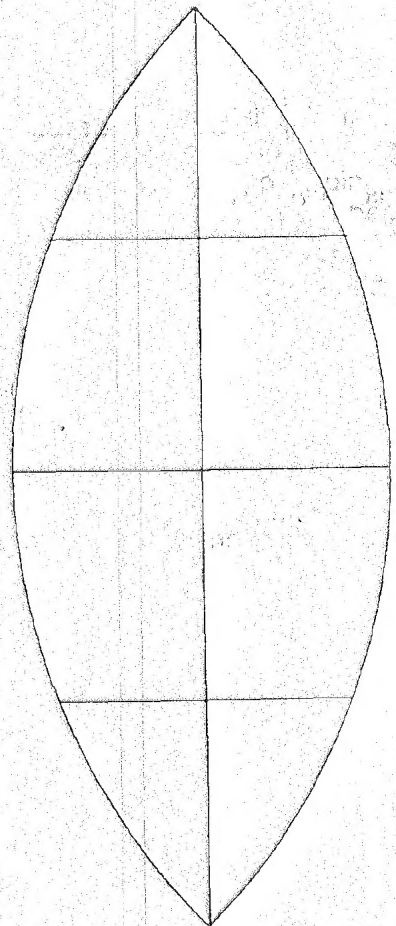
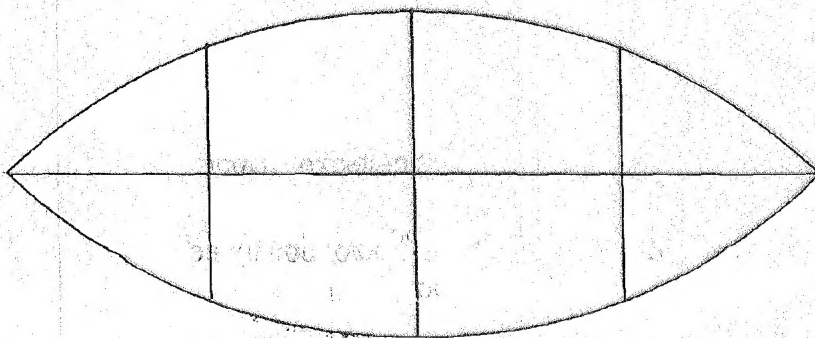
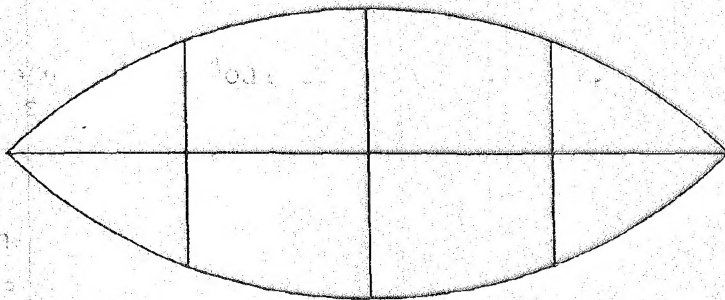
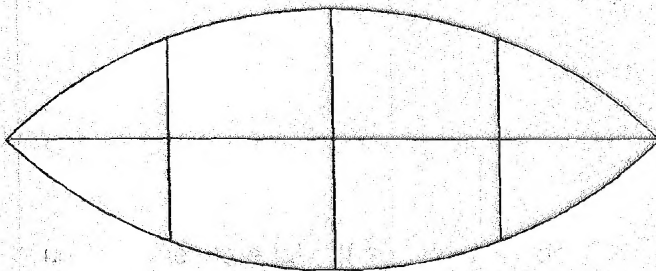
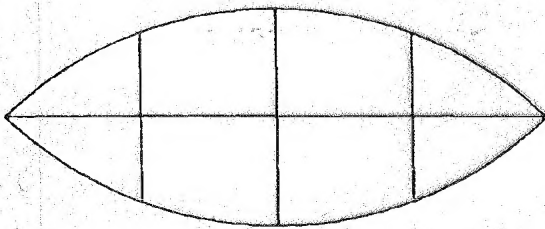
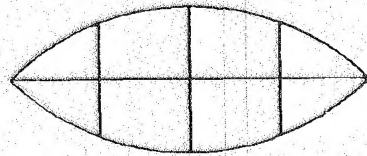
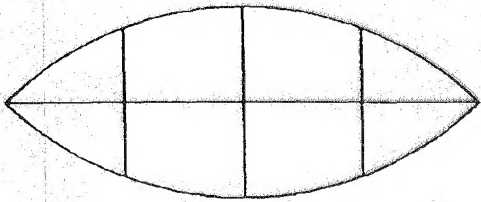
YOU CAN CASH IN ON CHAOS

1. ALL MARKETS ARE NON-LINEAR DYNAMICAL SYSTEMS
2. THESE SYSTEMS EXHIBIT PERIODS OF NEARLY PREDICTABLE BEHAVIOR, INTERSPERSED WITH EPISODES OF CHAOTIC BEHAVIOR
3. EVERY MOVE IN EVERY MARKET ON ANY SCALE FORMS A HANNULA MARKET FRACTAL
4. THE HANNULA MARKET FRACTAL CAN BE PROJECTED TO REASONABLY PREDICT FUTURE BEHAVIOR
5. THE HANNULA MARKET FRACTAL CAN BE TRADED SUCCESSFULLY

© 1994 Dr. Hans Hennula



© 1993, 1994 Dr. Hans Hanauka
Confidential Trade Secret



LEGAL NOTICE

The Cash In On Chaos video tapes contain trade secret material. To provide the protection required under trade secrecy laws, these tapes have been copy protected. This may produce some intermittent flashing of the image when the tape starts.

These tapes also have a uniquely recorded serial number, enabling any copies to be traced to the original purchaser.

These measures have been taken to protect both your investment and my own. They will not in any way interfere with lawful use of the product.

Dr. Hans Hannula